RADIO, TELEVISION and HOBBIES

Volume 23, Number 3 June, 1961

FM MUST STAY ON THE AIR

ACCORDING to a recent announcement, the Broadcasting Control Board has recommended the cessation of "experimental" FM Broadcasts, which have been conducted by the P.M.G. Department and the A.B.C. for some 10 years in Brisbane, Sydney, Melbourne and Adelaide. June 30 is the date suggested for the termination of transmissions.

Reason given for the step is that the frequencies are required for country television stations. As a further observation, it has been stated that very few people listen to FM.

In proceeding on such a basis, I wonder whether the Control Board has taken any cognisance of the many thousands of FM tuners which have been constructed by readers of this journal, or purchased through regular Hi-Fi equipment dealers; of the fact that every such dealer is currently displaying not one, but several, brands of FM tuner. This, despite the fact that the public has been kept in complete ignorance of the transmissions.

It has been suggested in trade circles that something like £100,000 is currently invested in FM equipment, a figure which does not include expensive audio gear with which FM tuners are commonly associated.

In point of fact, an FM service is a natural corollary to a Hi-Fi audio system and interest in Hi-Fi has never been greater than it is at present. The "audio" field alone remained active during recent months, when sales of television and radio receivers hit rock bottom. And just when the A.B.C., with its emphasis on music, is in the box seat to serve the rising interest in high quality sound, the essential vehicle is to be removed.

This is one recommendation that the Postmaster-General should certainly not "rubber-stamp." In the space still left between 92 and 94 Mc/s, it should be possible to fit not only the existing four transmitters, but enough others to supply major population centres with better quality transmissions or — let's face it — a third program.

A growing section of the public wants high fidelity music; the A.B.C. is anxious to meet the demand; a very large amount of money is already invested in what is actually a going concern. Then why in the name of all that's rational throw it on the scrap heap?

Last but certainly not least, a basic FM service with some security of tenure would provide an important new hook on which local manufacturers could hang urgently needed production and sales.

W. N. Williams

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Cover Picture:—

Jackie Branston, 18, of Willesden, England, was seated at the controls of a "Hover Scooter," when this picture was taken. Developed originally in America, the Hover Scooter was demonstrated recently on a lake at Long Ditton Surrey. Yet another variant of the Hovercraft concept, this new "one man" vehicle rides on a cushion of air at a height of about six inches. It has been suggested as having uses for rescue work at coastal resorts, inspection of water sights, off-shore drilling, etc.

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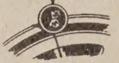
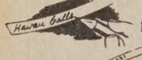
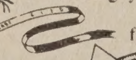
Look for these features on every famous BASF tape: factory seal  your guarantee of a brand new tape, red safety clip prevents unravelling, green and red leader  for writing your titles on. metal foil strip  for automatic stop recorders, swivel box never loses lid.

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P827

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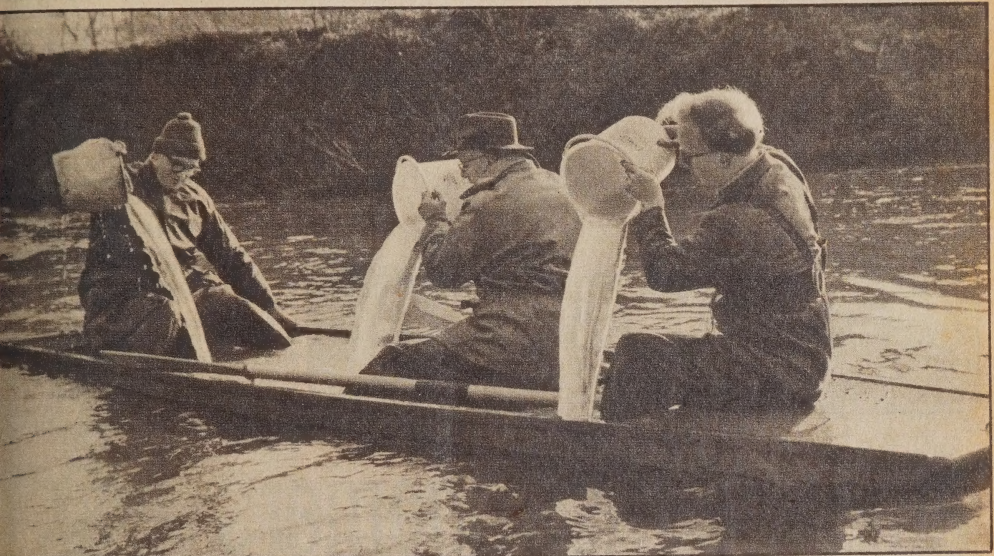
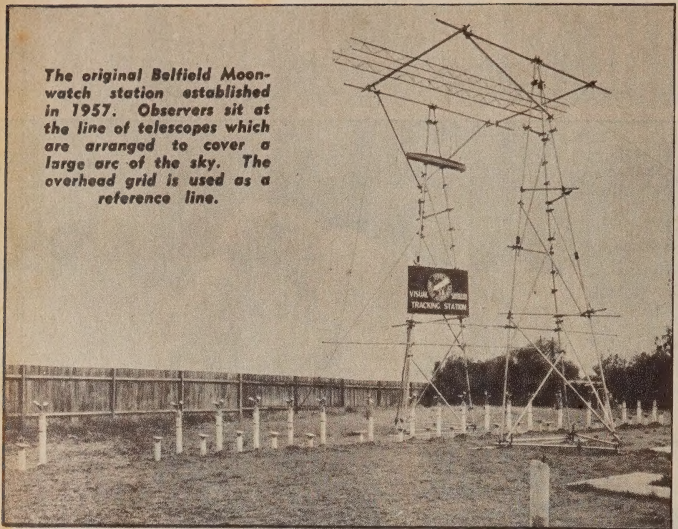


Reversing the usual procedure in a boat already nearly full to the gunwales, these men are baling in water on the River Mole at the Distillers' Sports Club, East Molesey, Surrey.

They are demonstrating that a new 14ft 6in fishing punt really is unsinkable, in accordance with the claims made for it. It is the first craft to be built entirely of rigid PVC (polyvinyl chloride) plastic, and a special feature is the special buoyancy sections built-in fore and aft.

The craft (which easily accommodates three men) is so stable that an angler may sit, stand or walk in it without fear of capsizing. The punt, which retails at £95, was designed by Imray and Wilson (Yachting) Ltd., in collaboration with British Geon Ltd., plastics manufacturers, and built by R. Giddins and Son, Hemingford Grey, Huntingdonshire.



The original Belfield Moonwatch station established in 1957. Observers sit at the line of telescopes which are arranged to cover a large arc of the sky. The overhead grid is used as a reference line.

Amateur Astronomers Playing A Vital Role

In this age of Earth satellites and giant radio and optical telescopes; and with interplanetary flight "just around the corner," one often hears the question: "What can the humble amateur do, in his spare time, with the modest equipment at his disposal? Can he make any significant contribution?"

By J. T. Davies*

WITH the possible exception of nuclear physics, astronomy appears to most members of the public as the science to which the amateur could contribute least. To them, this study of incomprehensibly large objects at stupefyingly great distances remains securely in the province of multi-million pound telescopes and fully-equipped observatories.

That this is far from the truth is both an encouraging thing for astronomy in particular, and science in general.

The atomic bombs and other modern developments of the militaristic art have coerced the ordinary person into thinking that he is merely a cipher in a push-button era, with no control over his own destiny: that his individual effort counts for nothing in the technological machine.

The purpose of this brief article is to indicate how the amateur, with his back-yard telescope can materially assist the professional astronomer — even to the extent of modifying present - day theories on the origin and constitution of the Universe itself.

In so doing, it is hoped that other amateurs — not necessarily astronomically inclined — will be given the incentive to re-appraise their work, and re-assess the important part they play in today's technological advances.

It is as true now as it ever was that society is composed of individuals. We each have our own particular talents, our own part to play in the scheme of things.

There are approximately 1,000 reasonably active amateur astronomers in Australia, belonging to such societies as the Sydney Amateur Astronomers, the British Astronomical Association (N.S.W. Branch), the Astronomical Society of Victoria, and similar organisations in Queensland, South Australia and Western Australia.

Most members of these societies have their own telescopes, usually built in the home workshop. These range in size from the elementary 2-inch refractor (lens-telescope) to 16-, 18-, and even 24-inch reflectors. (The dimension is the diameter of the main lens, or in the case of the reflecting telescope, mirror.)

The newly-interested amateur usu starts with a small war-surplus telesco or an inexpensive commercial mo Later, as he becomes more experienc and requires better performance, choice is most commonly a home-m reflector of some 6- or 8-inch apert These can be made for £20-£30 mater cost.

Larger reflectors could cost hundr of pounds and take several years construct, but are well worth the ti and effort provided the owner has come sufficiently familiar with the ty of research he has chosen to special in.

INSTRUCTIONAL COURSES

All the above-mentioned societies telescope making courses, and there no lack of expert advice and tuition the novice.

But telescopes are a means to an e observing. What useful work can amateur accomplish, given a sufficien large telescope and a little auxili equipment? This can perhaps be b illustrated by taking one of the societi and examining its various observatio programmes in some detail.

The Sydney Amate Astronomers have th headquarters at Belfie Observatory near Camps a suburb of Sydney.

They are 150 stro Members form small tea to carry out particular p jects, besides contributi individual observatio which are collated and tra mitted to other societ and professional obser tories.

Perhaps the most publicised activ of the S.A.A. is the "Moonwatc station it runs. This was set up duri the I.G.Y. to help keep track of American Earth satellites which were be launched then. Belfield Moonwat recorded the first passage of Sputnik to be observed outside the Soviet Uni and has since made many hundreds sightings of the various rockets a "space-ships" which have been sent i orbit by both America and Russia.

Satellite tracking illustrates one of chief advantages possessed by amateur astronomer over his professio counterpart. Most observatories clus in the northern hemisphere and are evenly distributed even there. This lea large areas of the Earth's surface (a the sky above them) without adequ coverage.

AMATEUR'S ROLE

The gap is admirably filled by ubiquitous amateur. Examination of membership list of the B.A.A. for stance, reveals its world-wide scatter. unified effort by amateur organisatio enables a 24-hour watch to be kept any specially interesting object such a decaying satellite, a nova (new sta a comet, or such a rare occurence the occultation of a star by a planet.

A program which promises a nota advance in our knowledge of the rad emission of stars (and which will ha repercussions in modern theories on t origin of the Universe) is at pres under way, members of the S.A.A.

*** Publication Editor and Committee Member, Sydney Amateur Astronomers**

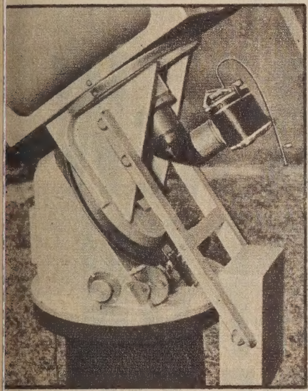
erating with the Radiophysics Division of the C.S.I.R.O.

Certain faint stars are subject to sudden increases in ightness, due to "flares" on their surfaces. Our Sun also s flares and these are usually accompanied by strong radio oise" and the familiar magnetic storms and "black-outs" Earth.

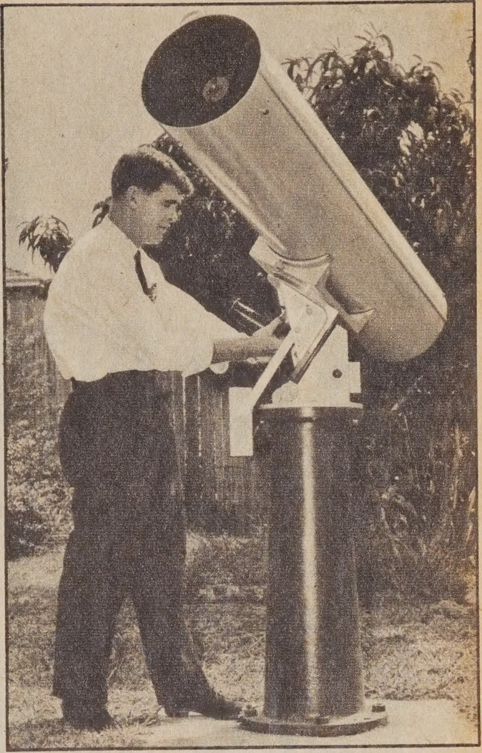
At the moment, the Sun is the only star definitely own to emit radio waves; the joint program is designed detect them from other stars. S.A.A. members watch for e visual indication of flares on stars such as Proxima Cenuri (the nearest star to the Sun) whilst the C.S.I.R.O. at St. arys records the radio noise from the direction of the same ar. Any correlation in time between an optical flare and a ak in the radio trace would indicate the probability that e noise was being received from the star in question.

Flares occur very infrequently, and it would not be praccable to tie up a busy observatory telescope for three hours ery night for months at a time, particularly when bad eather at the crucial moment could spoil the whole proram. Hence the peculiar advantages of the amateur tronomers' network of back-yard telescopes.

Similarly, the field of "normal" variable star observation pre-eminently that of the amateur. In New Zealand, dozen or so enthusiasts amass the uge total of over 14,000 estimates of agnitude each year. A single estiate is worthless, but the concerted ffort by these amateurs provides suffiient data to keep many professional stronomers busy for years to come.



A close-up view of Mr Miles' telescope, showing the setting-circles, motor-drive, and focusing arrangement. The chief advantage of the Springfield is that the telescope revolves around the eyepiece which remains stationary.



This 10-inch Springfield telescope was built by Mr G. Miles.

Most variable star work is done imply by visual estimation through the elescope, but there is plenty of scope, specially with short period variables, or the use of a home-made photo-electric hotometer. Such an instrument greaty increases a telescope's usefulness, ince it introduces an objective and imersonal weight to the observations.

In case any reader is diffident about is capabilities relating to telescope aking, there is one program of the .A.A. which needs absolutely no equipent whatsoever. This is Novasearch, ndertaken in conjunction with the merican Association of Variable Star bservers and kindred bodies in Ausralia.

The idea is to divide the sky into mall areas containing only a few stars ach, allocate an area to each particiant in the project, and have him exmine the area each clear evening to ee if a "new" star has appeared.

Most new stars (or novae) are found nly after they are several days old, uring the routine examination of photoraphic patrol plates, so the early stages f their development are still largely a ystery. The prompt reporting of a iscovery will enable much valuable pectroscopic data to be obtained by suitably equipped professional observatories.

(In parentheses, it should perhaps be mentioned here that novae are not strictly "new" stars — they are actually old stars which for some reason have suddenly flared into new life, thus becoming visible where before they had been too faint to be seen. It is thought that one day, millions of years hence, the Sun will pass through the nova stage, and in so doing incinerate the planets of the Solar System.)

Close-up of the moon, photographed by Mr G. Miles through his 10-inch telescope. The marked crater is Alphonsus, the scene of volcanic activity last year, as reported by the Russians. (35mm. camera, HP3, 1/25 sec.)

What else can the amateur astronomer do? Enough to keep him occupied for every night of the year!

Earth:

Estimates of the brightness of the night sky; the recording of the different phases, times, and shapes of aurorae (the fine display during the evening of 13th November last was typical of aurorae seen from the latitude of New South Wales); the Zodiacal Light and Gegenschein are interesting phenomena of the twilight and midnight sky respectively, and are one of the mysteries of astronomy susceptible to amateur investigation; the plotting of the paths of meteors—a department of astronomy which is particularly neglected in the southern hemisphere.

Moon:

Telescopes of 10-inch aperture and above are large enough to enable Earth-bound observers to chart the finer details of the Moon's surface. Careful drawing and photography enables us to know the shape of the surface features of the Moon probably better than the interior of Australia—and certainly better than Antarctica.

Mapping of the features around the "edge" of the Moon is still incomplete, and this is a first requirement in the interpretation of occultation observations.

When the Moon passes in front of a star, this is known as an "occultation." Since the position of the star is known

THE MAN SAID REPLACE IT WITH A NEW *Super* RADIOTRON PICTURE TUBE

I'm a businessman, and while I wouldn't dare admit it to m wife, I know nothing about the workings of our TV set, eve though we've had it almost four years. For that reason, whe the picture tube needed replacing last week, I told the Service man that I wanted the best possible picture tube available i Australia. One that was not only reliable, but also backed b a firm that offered immediate replacement and round-the-cloc expert service and testing. After mentioning these points alon with a price that I would be happy to pay, the man saic *"Replace it with a Super Radiotron Picture Tube."*

AWV

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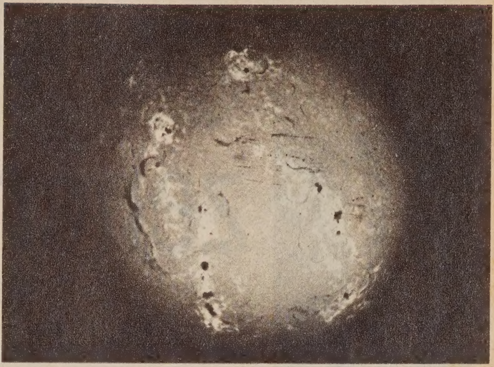
a high degree of precision, the timing an occultation gives us the position the Moon with a similar accuracy.

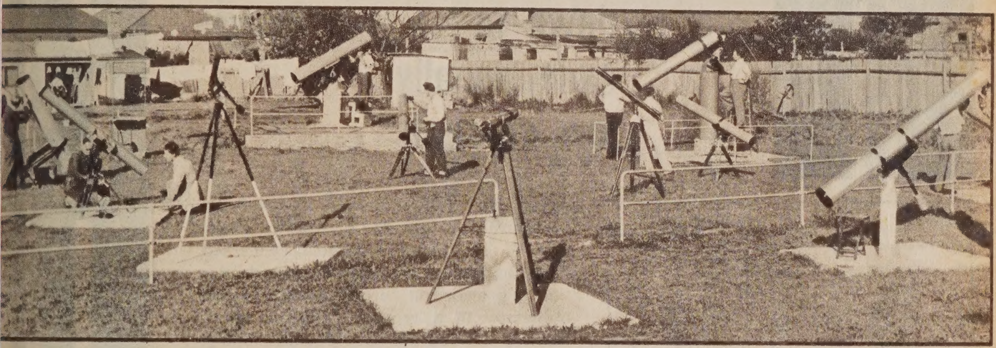
This, in turn, is of the utmost imrtance to navigation, and the Nautical manac Office in London is always erested to receive timings of these ents from amateurs.



A photograph of the sun using light of a single frequency, as given by a hydrogen - line filter. The dark spots are sunspots; the bright areas around them are the regions which give rise to solar flares. The photograph was taken, December 22, 1957. Dark streaks on the picture are due to imperfections in the negative.

Even observation of the dark side of Moon can yield valuable scientific ta. It is thought that the Moon has a ght but extensive atmosphere, and if s is so, it should present a better rrier to meteors than the Earth's does.

With the outlay of a great deal of oney, we could send a satellite around Moon (as the Russians did with nik III) to sample the atmosphere—t an amateur astronomer with a small escope in his back yard could do as ich, by observing telescopic meteors the lunar night sky.



Against a background of suburban backyards, various types of amateur-built telescopes are here shown being arranged in preparation for a public evening, in the grounds of the Belfield Observatory.

Much of our knowledge of the surce features of the other planets of the lar System is derived from the long ries of amateur observations through all telescopes. That this should be so not a reflection on professional astronners, or on their large telescopes, but ther is due to a fault of the Earth's mosphere.

All light reaching the telescope has st to pass through over a hundred iles of air, which is by no means ansparent or homogeneous. Variations density, both gradual and sudden, change the refractive index of the air, and hence the path of the incoming light ray.

A group of pictures of Saturn, exposed on the one negative, taken by Mr A. Marks, of Guildford, N.S.W., through his 10-inch Cassegrain reflecting telescope. Air movement complicates celestial photography and multiple exposures allow the best image to be selected.

The net effect of these movements is a "boiling" of the telescopic image and, for various reasons, this is worse in larger instruments than in small.

Several authorities have given a 20-inch reflector as the maximum useful size for visual observation of the planets, and this is certainly within the capabilities of the experienced amateur.

Detailed drawings of Jupiter's cloud belts enable us to trace the atmospheric currents girdling that distant planet—and it should be realised that we are only now, with the advent of satellites like Tiros B, mapping the winds in our own upper atmosphere.

Recently, visual observations of Jupiter have been used in an attempt to identify the source of the radio noise which is received intermittently from somewhere in the Jovian region. Latest findings pinpoint the cause as a vast van Allen radiation belt surrounding Jupiter, not in its upper atmosphere at all.

Many other aspects of amateur astronomers' activities cannot be touched upon in the present article. Suffice it to say that, for the diligent observer, there is always something useful to be done; some significant observation to be made, every hour of every night of the year.

There is sufficient diversity in the current programs being undertaken by the various societies that everyone, no matter what his particular talent, or type of equipment, or limitation of time, can certainly be found a niche in an observing team, and be assured of the opportunity of advancing our knowledge and the science of Astronomy.

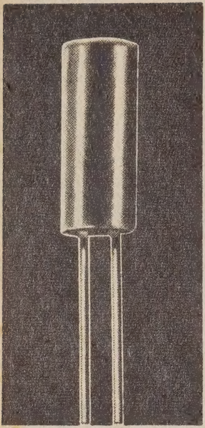
LARGE-SCREEN COLOUR TELEVISION

THE first public demonstrations of large screen (12ft x 9ft) simultaneous colour television to be held in Britain was seen by 400 delegates at the recent two-day convention on television and film techniques, jointly sponsored by the British Kinematograph Society and the Television Society, in London.

The large screen display was provided by the Marconi Company. It consisted of a colour television projector capable of accepting N.T.S.C. type colour TV signals by landline from the B.B.C. studios at Lime Grove.

The wide angle characteristics of the viewing screen enabled the large audience in the lecture hall of the Institution of Electrical Engineers—where the convention was held—to view the pictures with maximum clarity. Pictures of excellent brightness were obtained from colour slides and from 35mm colour film.

The demonstration—given during a lecture by Mr S. N. Watson and Mr A. R. Stanley of the B.B.C.—clearly showed that the British adaptation of the American system can provide a colour television service of excellent quality. Delegates to the convention also heard other lectures on colour television techniques and systems.



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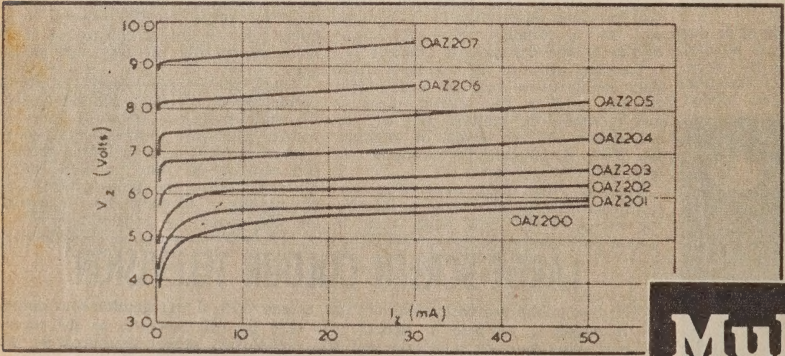
OAZ202	5.6	5.3	6.0
OAZ203	6.2	5.8	6.6
OAZ204	6.8	6.4	7.2
OAZ205	7.5	7.1	7.9
OAZ206	8.2	7.7	8.7
OAZ207	8.1	8.6	9.6
15% Tolerance Range			
OAZ208	4.2	3.3	5.0
OAZ209	5.1	4.4	6.0
OAZ210	6.2	5.3	7.2
OAZ211	7.5	6.4	8.7
OAZ212	9.1	7.7	10.6
OAZ213	12.2	9.4	15.0

Voltage stabilisation down to exceptionally low currents is provided by Mullard Zener Diodes. This feature is particularly marked in the higher voltage types where stabilisation is provided at currents as low as one milliamp. In all types the dynamic impedance is low and the zener characteristic is very sharp.

Two ranges of these diodes are available. One with approximately ±5% tolerance voltages, and the other with approximately ±15% tolerance voltages. In both ranges the change of zener voltage with temperature is only very small, and the operating temperature is from −55 to +150°C.



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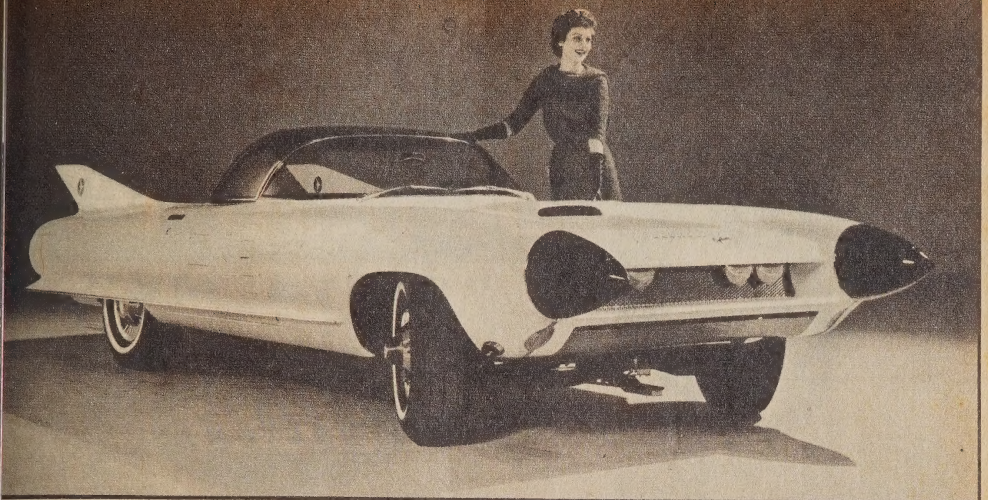

This Cadillac "Cyclone" features a 325 horse power motor with a compression ratio of 10.5 to 1. Does it typify the car of tomorrow?

FUTURE OF PREMIUM FUELS

ALES of premium grade motor
spirit have recently exceeded those
standard grade for the first time
ce the oil industry re-introduced two
des of fuel in June, 1955.

This is explained largely by the dis-
pearance of a large proportion of pre-
r vehicles, and their replacement by
wer models which are designed to
lise the increased powcr available
m the improved fuels.

Most people know that the greater
wer and economy of modern engines,
npared with their pre-war equivalents
similar size and general design, is
gely the result of higher compression
io, made possible by fuels of higher
tane rating.

Will this trend continue? Is it possible
lefinitely to improve engine perform-
ce by this simple expedient as petro-
m chemists continue to improve their
oduct?

If so, the conventional piston petrol
gine is capable of considerable further
velopment, for petroleum fuels with
octane rating as high as 115 are
hnically possible and are being pro-
ced for piston-engined aircraft. In the
ited States premium fuel of 102
tane can be bought at the pumps.

Unfortunately, there is a law of dim-
ishing returns in the improvement of
rformance, by lifting compression
tio whenever the petroleum chemists
me up with a higher octane rating.

Since the war, spectacular gains have
llowed a lift from 6 to 1 up to 10
1. But the gain is greatly reduced
en a further lift is made even to
to 1; and to make matters worse,
me formidable new problems arise,
some of which no solution is yet in
ht.

It is to be expected that stresses
roughout the engine will be increased,
t the metallurgists no doubt could
al with that as successfully as they
ve in the past.

More formidable are new kinds of roughness and noise which mar an engine's performance, and are quite different from ordinary detonation. New names have had to be coined for them: "wild ping" and "rumble" are samples.

Besides these "physiological" problems are "anatomical" ones: the geometrical configuration of the engine begins to break down as compression ratio is pushed upward. This problem is concerned mainly with the poppet valves for which no satisfactory practical commercial substitute has yet been found.

Poppet valves must be accorded combustion chamber clearance to function, for the immutable laws of gas flow require that at the top dead centre they must be open, at the vital moment when the exhaust stroke has been completed and the induction stroke begins.

This limits the degree to which the combustion chamber can be restricted in order to obtain the highest possible compression ratio, even when recesses are formed in the piston head to accommodate the open valves.

The tendency today is to increase bore and reduce stroke, thus keeping down piston speed while increasing the crankshaft revs. per minute. But it also means that an engine of this configuration is still further limited in the compression ratio which can be achieved than one in which the stroke is long and the bore is small.

The motor vehicle is essentially practical. It must remain not only simple in use, but economical in both production and maintenance. This rules out alternative valve systems so far tried, and many of the alternatives to the spark-ignited petrol engine.

It is significant that in countries where petrol is exorbitantly taxed, such as France and Italy, the popular answer to the need for super-economy has lain so far in smaller conventional engines and lighter vehicles.

Even in wealthy America the long trend to bigger cars with ever-increasing engine size and power is being replaced by more "compact" cars.

Altogether, it seems there is not much likelihood of any considerable further development in conventional petrol engines, failing some radical new departures not yet indicated, and therefore no present reason for producing fuels of higher octane rating than those already commercially available.

The supercharger is a well-explored accessory for boosting power, but cost, noise and the need for an extra drive are against it. More power might also be obtained by providing for freer engine breathing, but carried to excess this produces inflexibility with which an average driver cannot cope.

On the other hand, the future may lie with alternative engines of far less delicate appetite. For various reasons, not the least being the conservatism of the average motorist and the devotion so far of the popular manufacturers to spark-ignition piston engines, this future seems fairly remote.

What are these alternative engines? The most obvious is the diesel, well

Will the octane rating of petrol continue to rise indefinitely?

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MS 0

oven in both high specific fuel econ- ny and longevity. This type of unit s long been used in sizes suitable for rs, but has continued to be restricted big-mileage vehicles such as taxis due higher initial cost and unacceptably ugh running.

Because of the high stressing from . compression ratio of up to 20 to 1, e diesel engine is more costly to build, d the high-precision injector unit costs any times more than a carburettor.

Experiments with gas turbines in zes suitable for biggish private cars ve been under way for years, but so r their practical transport field has mained in the large-size classes of rcraft, with excursions into marine, comotive and heavy commercial uses.

A major difficulty in scaling down a rbine lies in its dependence for ficiency on extremely high peripheral tor speed. Once the rotor comes down a car size its shaft r.p.m. presents a rmidable problem in gear reduction one.

The free-piston multi-fuel engine hich has recently become important r military transport is a gas turbine which a free-piston compressor unit places the centrifugal compressor sec- on of the conventional turbine.

Its omnivorous characteristic is really value only in military conditions, to nprove fuel availability in difficult pply circumstances. It is costly, and racticable only in large sizes.

The most promising of the revolutionry new engines for the everyday car ems to be the vane or rotary-piston ngine, of which the Australian Body- omb engine is a variant.

The Wankel, first publicly announced sign, is due to appear commercially an alternative version of the N.S.U. rinz light car, which will hit the Geran market in 1962.

With fewer moving parts than even lawnmower two stroke, the Wankel cores heavily in power-to-weight ratio nd space requirements in the vehicle. ut the design does not appear to lend self to the use of very high compression atios, so octane rating of its fuel is nimportant.

Vane type engines appear to offer ery favourable production and mainenance cost, with inherent smoothness nd mechanical quietness in the turbine lass, but they have yet to prove hemselves in everyday service.

It seems, then, that the conventional eciprocating piston type of petrol en- ine is likely to continue in use for at east a considerable time, but that further mprovements in octane rating will be f less importance than they have been n the recent past.

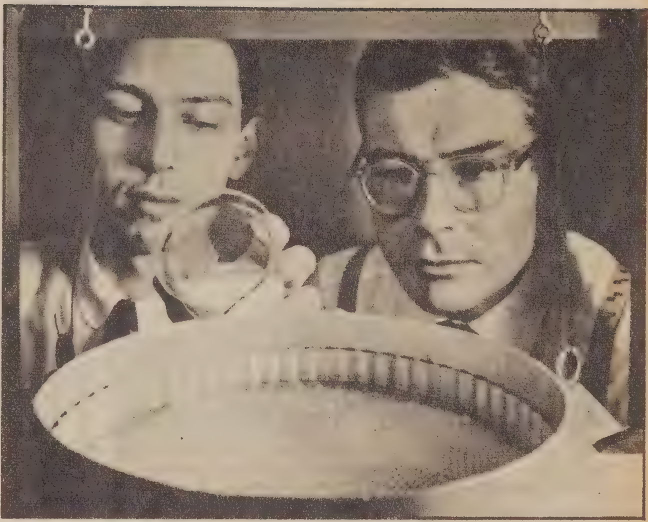
Improvements are more likely to be in he fields of durability and weight re- luction than of b.h.p. per litre, pro- luced the simple way by increasing com- ression ratio as improved fuels will llow.

All in all, operating economy is now robably the most cogent of sales forces, ogether with minimum initial cost and mooth, quiet running.

Engine performance is now so good hat few drivers, even of small cars, abitually use all the power that is at heir disposal. Any gains in that direction hich would necessitate the sacrifice of ther virtues such as low production ost, ease of maintenance, and economy, ould not be worthwhile.

[By courtesy of the Petroleum Information Bureau (Australia).]

BEADS SIMILATE ATOMS



Fenced in on a jiggling plate, glass beads act out the role of atoms, as Robert Cormia (left) and David Turnbull watch.

A MECHANICAL model that demonstrates how atoms move in gases, liquids and solids has been developed by David Turnbull and Robert Cormia of the General Electric Research Laboratory.

The device, in which several hundred beads jostle each other on a vibrating platform, is helping in the solution of one of modern science's most important problems: How atoms move in liquids.

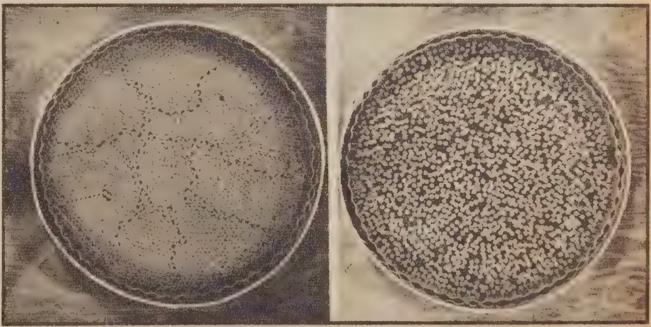
In the model, the glass beads are stand-ins for atoms. They are poured on to a round glass plate with a "fence" around the outside to keep them from rolling off. The plate, suspended from springs, is vibrated constantly by a motor mounted beneath it.

The constant motion leads the beads to behave as atoms are supposed to do. This behaviour can then be photographed and studied.

"The properties of matter result from the interaction of many atoms," says Turnbull. "The long--range objective of material science is to calculate these interactions and thereby predict the behaviour of matter. However, precise calculations are very difficult and models can be of use by suggesting how such calculations can be simplified.

"Most models developed heretofore have had the shortcoming of not illustrating atomic motion. In the present model, a remarkable number of atomic interactions are illustrated."

When only a few beads are on the plate, they behave like atoms in a gas, moving rapidly over long distances between collision and arranging themselves in no particular pattern. As more and more are added, they behave like a liquid, and eventually like a solid, forming several large areas separated by the equivalent of grain boundaries.



The picture at the right shows the beads similating atomic behaviour of atoms in a liquid; they are lossely packed with no pattern visible. At left, a "solid" has formed; the pattern of grain boundaries between adjacent groups of atoms can be clearly seen.

Water gushes from a bore at Baroona Station, near Julia Creek North Queensland. Emerging at a temperature of 204 degrees F., the water fills a nearby dam, flows along 70 miles of bore drains and serves five different sheep stations covering an area of 80,000 acres.

Vast Supplies Of Underground Water

One of the most valuable of all the phenomena of nature is the occurrence in many parts of the world of large underground reservoirs of water. It sustains life and industry in areas which might otherwise be written off as useless.

by Calvin Walters

THOSE of us who live in cities or towns, which have adequate supplies of water available at the turn of a tap, give little thought as to how those who have not that facility manage to get their water supplies.

Most of us think in terms of rainfall, storage dams or household tanks which collect the water from the roofs of buildings.

This is only half the story, as there are thousands of people who live in areas where rainfall is scanty, so that storage from rainfall is not adequate. Some areas of Australia have no rain to speak of for years on end, as is the case with other arid areas of the earth.

People who live in such places rely, to a tremendous extent, on the tapping of underground water systems, not only for their domestic requirements but also for water for their cattle and for irrigation purposes.

Nothing on the earth can live without water, despite the assertions of chronic inebriates. Even these people rely on water for the production of their condition for, without water, there can be no alcoholic beverages.

The tissues of which all living things are composed require water for their development many times in excess of the weight of the tissues themselves. It naturally follows that abundant supplies of water are absolutely vital for the porous rocks, where it is contained in development of plants or animals.

The presence of underground water systems has been known from very early times. The Chinese and Egyptians were well acquainted with such sources of supply. This seems only right, as the ancient Chinese and Egyptians seem to bob up in almost everything worthwhile in human history.

The name generally given to underground water systems is "Artesian" from the fact that the oldest known well in Europe was sunk in Lillers in Artois in the year 1126.

Wells were sunk in London in 1844 to a depth of 390 feet. These supplied the water for the Trafalgar Sq fountains. Other wells appear now i most of the arid countries of the wo including the Sahara Desert.

The latter wells are a good exam of how plentiful supplies of water change not only the face of the la but the character of its inhabitants.

Prior to the sinking of wells in Sahara, the Arab tribes were enti nomadic, wandering from place to p in the never-ending search for wa With the sinking of wells, these tr have settled near them and formed c munities, building houses, cultivating land and completely giving up t nomadic life.

THEORIES AS TO SOURCE

Various theories have been put ward to account for the source of water in underground systems, the m notable of these theories being Meteoric Theory, the Plutonic The and the Connate water Theory.

The Meteoric theory says that underground water is derived solely fr the atmosphere. Rain is formed falls to the earth. Part runs off i streams, part soaks into the soil fr which it subsequently evaporates part percolates through the soil i porous rocks, where it is contained cracks and crevices.

The Plutonic theory maintains t deep in the interior of the earth th is an enormous amount of water vap in addition to the gases oxygen hydrogen.

These gases under certain conditi could combine and form water. aqueous vapour when cooled, u rising to the surface, can condense i liquid water.

Certain credence has been given this theory by the fact that water be condensed from gases escaping fr volcanoes and that some igneous ro which have been sampled contain ab 2 per cent of water, part of which free and the balance in combination w certain minerals.

The Connate water theory asserts t water was trapped in basins and hollo when the porous rock strata was depos ed. This was overlaid later by clays a shales and the resulting pressure of t overlay forces water to the surface.

Both the Plutonic and the Conn water theory, it will be seen, wou limit the supply of water, as these the accumulation of past ages. In course of time the supply would be hausted.

The Meteoric theory on the ot hand asserts that the supply is be constantly replenished by rainfall, only in the immediate vicinity of underground system but from rainf hundreds and even thousands of mi away. The explanation for this will seen later.

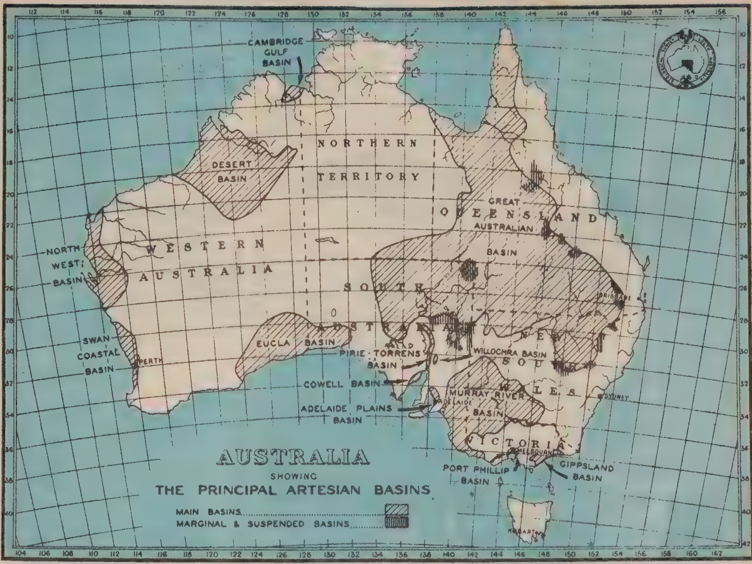
It is now accepted that it is this wat named meteoric water, which accou for the greatest proportion of that co tained in underground storage system

Even under the Meteoric theory t

si ply of underground water is ot inexhaustible for it dep ds on sufficient water fl ving into the system to rep ce that which has been p nped out. In times of se ere drought, pressure in th well or bore can lessen to s h an extent that deeper w ls or bores may need to b sunk to tap the water furth down. This fact has led t scientific conservation of th supply and flow from b es in various parts of the c ntry.

he areas in which underg und storage exists are c ed "basins." These occur i many parts of the world b probably the greatest in e ent is the Great Australi Basin which covers an a a of about 600,000 square m es or about 22 per cent of th area of the continent.

t extends from the Gulf o Carpentaria in the north to W ite Cliffs in the south, a d ance of about 1,000 miles, a in width from Oodnad ta in the west to Toow omba in Queensland in the e t a distance of 1,200 miles.


CAMBRIDGE GULF BASIN
DESERT BASIN
NORTHERN TERRITORY
QUEENSLAND
GREAT AUSTRALIAN BASIN
NORTH WEST BASIN
WESTERN AUSTRALIA
SOUTH AUSTRALIA
SWAN COASTAL BASIN
PERTH
EUCLA BASIN
PIRIE-TORRENS BASIN
WILLOCHRA BASIN
NEW SOUTH WALES
BRISBANE
SYDNEY
COWELL BASIN
ADELAIDE PLAINS BASIN
MURRAY RIVER BASIN
VICTORIA
MELBOURNE
PORT PHILLIP BASIN
GIPPSLAND BASIN
HOBART
AUSTRALIA
SHOWING
THE PRINCIPAL ARTESIAN BASINS
MAIN BASINS ▨
MARGINAL & SUSPENDED BASINS ▥

Artesian water is available over vast areas of the Australian continent, as indicated by this map.

n approximate figures the G eat Australian Basin covers 4 ,000 square miles in Queensland, 8 000 square miles of N.S.W., 30,000 s are miles of the Northern Territory a l 120,000 square miles of South Aust lia.

THER SYSTEMS

There are other Artesian basins in A stralia, the most notable of which a the North West basin of 48,000 s are miles in north-western Western A stralia, The Eucla Basin of 17,000 s are miles along the Great Australian B ght at the border of Western and S uth Australia.

Then there is the Murray River Basin o 107,000 square miles covering south- w st New South Wales, portion of n thern Victoria and eastern South A stralia. It will be seen therefore t t Australia is particularly well off in th way of underground storage systems.

The Great Australian Basin is situa d in a vast depression in the crust o the continent which is flanked in the e st by the coastal ranges in New South W les and Queensland and along the c tral and South Australian margins. T ese ranges are known as the intake b ds where water, deposited on the r nges, finds its way down through poro s rocks into the vast underground r ervoirs of the basin, flowing slowly f r hundreds of miles to benefit the g eat dry inland.

The porous rock, through which the w ter flows and in which it is contained, i known as the "aquifer." This term i cludes the cavities and cracks which act a reservoirs.

Without going into technical geological m tters in our explanation, it is suff ient for a general idea of the mechani m of the Artesian system to state it as f lows.

Water falls on the catchment flanks o the basin, where it soaks through t e overlaying soil into outcrops o porous sandstone-like rocks. Gravity c uses it to flow slowly downwards where it enters cavities, spaces and cracks to form natural reservoirs from a few feet to thousands of feet below the surface.

Artesian Basins are usually of a one-sided nature so that water flows into it from one side and out of it at the other. This is usually into the sea where the porous rock formation enters the sea at a lower level than the intake beds. In the case of the Great Australian Basin the outlet is into the Gulf of Carpentaria.

Other outlets are in the form of "Mound springs" which occur principally on the western edge of the basin. The springs are an interesting phenomenon. Where the pressure of the water is great enough it rises to the surface at the junction of the porous rocks with the underlying strata. It is really a natural artesian bore and brings with it dissolved mineral substances.

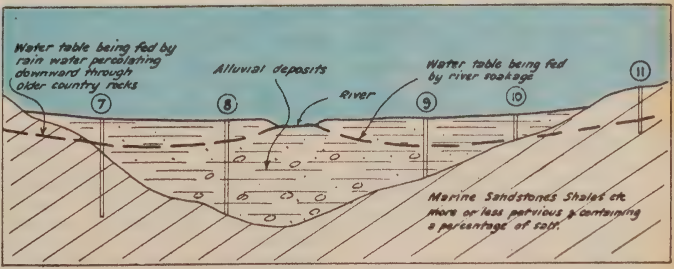
MINERAL CONES

These mineral substances are deposited around the point of emergence of the spring, with the result that, over a period of time, a conical mound of mineral substances is formed around the opening. These mounds range in height from a few feet to large mounds 130 feet high with a base of several square miles. The latter are very ancient and point to a great flow in early times, when rainfall was greater than today, with a consequent greater flow of artesian water.

Water in an underground storage system may be under pressure. This pressure is caused when water is contained in cavities which have no free access to the air. The pressure of the water above increases the pressure below.

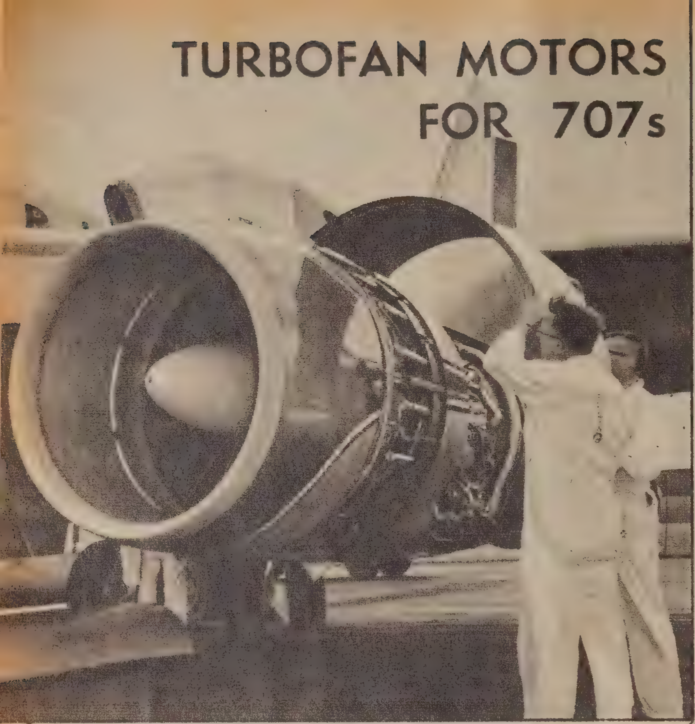
When such a cavity is tapped by a bore the water rises in the bore above the level of the ground water outside the bore. This level is called the water table.

Where the pressure is great enough to cause the water to rise above the level of the ground the water is called "Artesian Water" and the bore is an "artesian bore."


Water table being fed by rain water percolating downward through older country rocks
Alluvial deposits
Water table being fed by river soakage
River
⑦
⑧
⑨
⑩
⑪
Marine Sandstones Shales etc more or less pervious & containing a percentage of salt.

Along a sandy sea coast, fresh water, moving towards the sea floats on top of salt water, as illustrated. Bores sunk to a suitable depth can therefore produce fresh water very close to the ocean or to tidal creeks. The rate of pumping may have to be limited, however, to prevent salt water reaching the intake of the bore.

TURBOFAN MOTORS FOR 707s



AS noted in our last issue, new Boeing 707 jetliners, plus many of those currently in service, are being fitted with Pratt and Whitney turbofan engines, as illustrated above. These will considerably modify the appearance of the aircraft but will also improve speed, range and economy. The turbofan-equipped Boeing is claimed to be the fastest airliner in the world.

Easily removeable cowling segments give ready access to the forward or fan section and to the thrust reversers. First units of the Qantas fleet, equipped with turbofans, are due to go into service shortly.

UNDERGROUND WATER (continued)

If the pressure is great enough to cause the water to rise above the surface at which it is met but not above the surface of the ground it is called "sub-artesian water" and the bore is a "sub-artesian bore."

By continued flow it is possible for an artesian bore so to lose pressure that it ceases to flow above the surface and so becomes a sub-artesian bore.

There are many places where water merely accumulates under the surface and where no pressure exists, so that the water table is constant. In other words, when a bore is sunk into such storage, the water does not rise above the surface at which it is met.

"GROUND WATER"

The most notable areas containing such water known as "Ground water" are those in the soft sands around Sydney and Newcastle. The areas around Botany, Maroubra and Waterloo in Sydney covers about 12 square miles. It consists of sand beds from 50 to 150 feet deep which are saturated from water flowing into it from the high surrounding catchment area. About 5 million gallons of water are pumped daily from this area for use by surrounding industries.

HUGE AREAS

Near Newcastle, at Tomago, the sand beds cover an area of 50 square miles, from 50 to 70 feet deep. These are saturated with water and, at present, about 10 million gallons per day are being pumped from the area. It has been estimated that half a million gallons per square mile per day could be pumped from the sand if properly worked.

The procedure today of finding the correct place to sink a bore to obtain water from the Artesian system is quite scientific and calls for the services of trained geologists and hydrologists.

There are many people who still believe in the efficacy of the art of "dowsing" or finding water by means the divining rod.

This method has been used from t very earliest times. The Medes and t Persians and those living in the times Cicero and Herodotus used it. So d our ubiquitous friends the Chinese.

People in those days also used t divining rod for such purposes as loc ing treasure, finding perjurers a witches and so on.

The method uses implements rangi from pieces of wire to forked sticks certain trees, notably the willow. grasping the implement in a certa fashion and going walkabout over t land the sudden distortion earthwa of the implement denoted the prese of water.

STILL UNEXPLAINED

The action of the rod is believed be caused by certain muscular contr tions and no satisfactory explanati has been found for it. Some refer clairvoyance and other spiritual matt and the firm believer is hard to c vince that, although there is no dou that supplies of water have been fou by this method up to a point, it is by any means an ideal way to about things.

Records show that of 1708 bores termined with the "rod" in New So Wales, 14 per cent were failures, 17 cent struck water of a flow of less th 100 gallons per hour or were of unusa water.

On the other hand, of 1636 bo located by more scientific means, o 8 per cent were failures and 8 per c unserviceable.

The idea is not just to find water to find ample water of good quality

Good supplies of serviceable water not to be found everywhere, even in area of the artesian basin. It requi a close study of the terrain and geological formation of the rocks outcrops. Certain localities in the area offer better prospects than oth because the geological formation is m favourable for the storage of water th others. In addition, study of the ro may perhaps reveal that there are minerals to be dissolved in the water it percolates through them to the stor below.

TEST BORES

Having found a likely location, bores are usually sunk and these, in long run, are the final arbiters as the suitability of the location.

Test bores ascertain the nature thickness of the layers of strata over water-bearing rocks and valuable in mation is obtained as to the types screens to be used in the bore to prev entry of matter which would clog pipe.

The bore is started through soil, and shales by means of ordinary rot drills driven either by hand or by machine. The standard post hole dig is an example. As the drilling progre the hole is cased by driving a pipe do to prevent caving in of the earth.

When loose sand and gravel reached, the casing is inserted to t

(Continued on page 109)

Dual

1006 for Perfection in MUSIC

1006

1006

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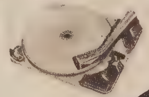

1006D

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Television history was made at night, at 10 p.m. to be exact, when a 45-second "live" Commercial was flashed across Europe from race-track to the screens of Britain's TV network within four hours of Stirling Moss winning the Monaco Grand Prix.

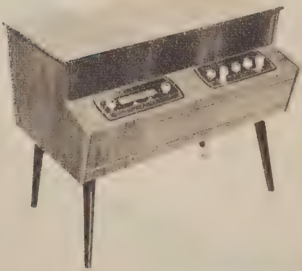
A telephone interview with the winning driver was recorded over land lines from Monte Carlo to the A.B.C. studios, while photographs were wired to Fleet Street and rushed by motor-cycle to Teddington. For permission to reproduce this picture of the editing of the interview we are indebted to The Dunlop Rubber Company Limited and Charles F. Higham Limited, their Advertising Agents, and to A.B.C. Television Limited, in whose Teddington Studios the photograph was taken.

Evidence in Camera

Varislope Stereo
LEAK

Of interest not only for its story, this picture has provided (quite unintentionally) striking evidence of the reputation enjoyed by LEAK. It is a typical incident of the use of LEAK equipment by professional audio engineers in broadcasting and recording studios throughout the world, who choose LEAK for quality of performance and reliability.

Does **your** installation measure up to these standards? If it does not, your LEAK Dealer can help you. The prices of LEAK studio quality equipment are made possible only by world-wide sales.



The new LEAK Varislope Stereo pre-amplifier (illustrated above) incorporates facilities which make it the most comprehensive pre-amplifier presently available.

Whether you are for Monaural or Stereo, LEAK equipment offers you the best of either. These suggestions may help you.

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BBC's ROOM 13 SPECIALISES IN WEIRD AUDIO

was looked on as a startling innovation when the BBC for the first me included an electronic musical work in the 1960 Promenade oncert Season in London ("Perspectives" by Luciano Berio). The udience listened with polite, but somewhat uneasy attention and ere clearly glad to see the orchestra return to the platform to continue the concert with "natural" music.

SPACE OR SPOOKS MADE TO ORDER

YET probably most of those present, in their normal day-to-day listening to B.B.C. broadcasts, had heard a good al of electronic music before—certainly many electronic unds. Not, indeed, music intended to stand on its own a separate work; but forming an integral part of a pro-am, heightening its intensity and meaning.

All sorts of sounds, and quite a few signature tunes or example, the one that introduces the General Overseas rvice program "Science and Industry") are composed, or anufactured, in the B.B.C.'s Radiophonic Workshop. Its rvices are on call to all B.B.C. producers, both of sound d television programs, and the staff are sometimes hard t to it to keep up with requests.

The B.B.C.'s Radiophonic Workshop, the first of its kind Britain, was set up in 1958, with the aim of developing e technique of producing electronically the kind of special fects and incidental music appropriate, and often essential, many modern radio and television productions.

In an age when machines can speak, and men can some-mes scarcely find words to express themselves, when the tion of a play is as likely to take place in outer space in the inner psyche as on the familiar earth, sound plays n enormous part in conveying mood and emotion and in ggesting an atmosphere of the larger and stranger than fe.

HOW IT STARTED

The first script written specially for radio by the dis-nguished playwright Samuel Beckett ("All That Fall," com-issioned by the B.B.C.) clearly called for sounds that ould not be produced by the old conventional means, and is production spurred on the idea of setting up a radio-honic workshop. But it was not until the use of magnetic pe had become general in the B.B.C. that it became a ractical proposition; although of course experiments with usique concrete and electronic music had been going on Europe for many years, notably in France, Germany and aly.

Frederick Bradnum's "Private Dreams and Public Night-ares" was the first B.B.C. production written specially to ploit the new medium, and this was sued by the B.B.C. Transcription Ser-ce and widely heard outside Britain.

Other early successes to which radio-onic sound made a vital contribution ere James Hanley's "A Winter Jour-ey" and "The Ocean." Many will re-ember the haunting opening theme of e latter, setting the scene of five men drift in an open boat; this was based n two notes of an E-flat clarinet, which ere "treated" electronically. Since then, eady advances in technique have been ade in a task which calls for a high egree of imaginative co-operation with roducers, for sounds and music must ally "fit" each individual work.

While space serials and what are ommonly called "weirdies" obviously ake big demands on the radiophonic orkshop, they are by no means the only pe of programs that do. Radiophonic und has been used very effectively in omedy; it provided an awe-inspiring orm in John Masefield's "Good riday," broadcast by the B.B.C. during aster, 1960, and it was clearly the most itable accompaniment for the program the B.B.C. TV series "The Artist peaks," which dealt with the work of bstract painter Victor Pasmore.

At the opening of the 1960 Radio Show in London, music composed by the radiophonic workshop to accompany a sequence of a dancer shown on a giant television screen was so effective that a number of people inquired where the record could be bought. Quite recently the workshop composed new theme music for the opening of the B.B.C. television transmissions each day to accompany a visual sequence of the new Television Centre.

Besides being appropriately modern, the theme music had to be easily recognisable, compulsive, cover a fairly wide range of frequencies to allow viewers to tune their sets if necessary, and contain a sequence lasting 10 seconds to enable regions outside London to switch in during that time; it also had to contain an echo of the television march by Eric Coates which had previously been used. Altogether no easy order, but successfully fulfilled.

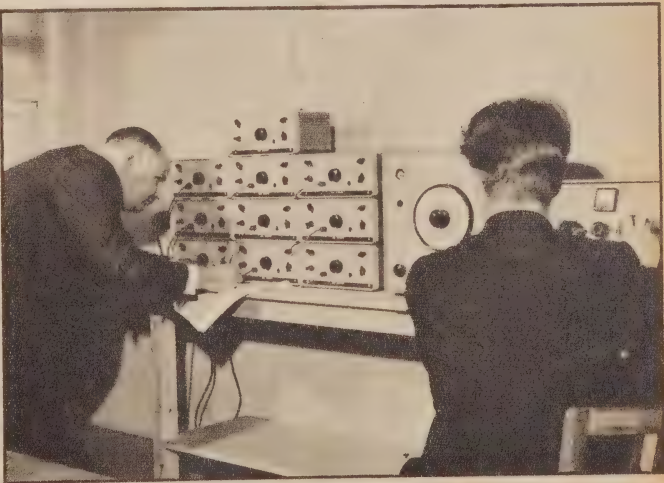
IN THE WORKSHOP

Everything is for the ear and nothing for show in the B.B.C. Radiophonic Workshop. It consists of a medium sized room (Room 13) with a small studio beyond, conveniently close to the B.B.C.'s big music studios at Maida Vale, so that natural musical sound is always available if the workshop wizards want to start from that basis.

There is not much space to move between the tape-recorders, oscillators, amplifiers, echo machines, filters, cross-plugging and distributor panels, with a gramophone turntable and a mixing-desk thrown in for good measure. Loops of tape hang from hooks around the walls looking rather like an array of dog leashes, labelled variously "Guns," "Trains," "Crashes," "Creaks," "Wind," "Water," "White Noise," and so on.

There, a small band of enthusiasts pursue their experiments in creating new sounds, persuading tape recorders to produce complicated rhythms beyond the powers of any human performer, searching, perhaps, for the note of a truly celestial trumpet, or an effect that will suggest the workings of a time machine casting back, or forward, a thousand years: seeking the sounds which will best express

(Continued on Page 111)



Desmond Briscoe, senior Studio Manager of the BBC's Radiophonic Workshop, and Charles Clark-Maxwell using a bank of tone sources to create a complex sound structure.

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Technical Review

EMOTE CONTROL TV CAMERA FOR SMALL STUDIOS

This article, written by G. W. Larkby of the BBC designs department, describes a clever arrangement whereby unattended cameras in remote studios may be adjusted for pan, tilt, focus, and lens angle, using simple telephone line circuits. It also allows a number of pre-arranged combinations to be set up in advance and switched in as required.

I recent years the stability of vidicon cameras has improved to the de- ge that it is now possible to use them hout the attention of technical opera- ts. The first example of the use of unattended camera in this fashion s, in fact, in the B.B.C.'s Parliamen- ty Reporting Studio at Westminster ich was put into service about a year o.

This studio is as simple as it is pos- le to conceive a television studio to consisting of a small room furnished th a table and chair, light, micro- one and a single television camera in fixed position. The studio is brought o action by remote control from the levision News Studio at Alexandra lace where the received signal is ixed" into the program.

MPROVED FACILITIES

The operational success of this facility, nple as it is, stimulated a demand to be le to control the main positional func- ns of the remote camera in order to e variety to the presentation. In turn, development of the apparatus for this sitional control has led to the provision a facility whereby the camera can made to take up any one of a num- r of preset "shots" by the operation a push-button switch, which may, if sired, be operated by the "subject" mself.

The camera functions which require to controlled are horizontal angle (pan), rtical angle (tilt), angle of view (focal ngth of lens), camera focus and lens erture. In order to avoid a hiatus in e picture while changing the focal ngth of the lens, advantage can be ken of a zoom lens.

As a field experiment, a vidicon camera s been fitted with a zoom lens and is stalled in the B.B.C.'s studio in All uls Hall, near Broadcasting House, d the camera can be controlled in all main functions, either from the local ntrol room or from the control room Alexandra Palace, some seven miles vay.

The camera is a standard vidicon, of type in general use in interview studios here it is normally fitted with a four- ns turret. For the purpose of this ex- riment, the turret was removed and re- aced by a cast plate on which is mount- the zoom lens together with the motor mechanisms for the zoom, focus and iris movements.

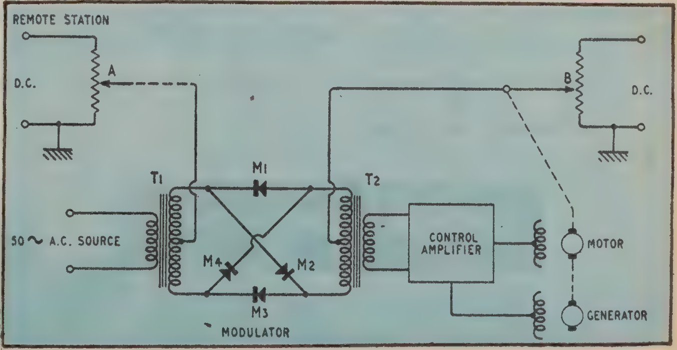
The servo system employed is shown in Fig. 1. The two potentiometers, A and B, form a bridge circuit of which the potential difference, at D.C., between points A and B, is fed to a modulator, which detects the potential difference between these two points and provides a correcting signal, which, in turn, operates a motor so that the two points are brought as nearly as possible to the same potential.

The modulator circuit employed is the well-known "ring" connection of four diodes to which, in addition to the D.C. control voltage, a constant 50 cps EMF is also connected. In order to keep harmonics in the output voltage to a reasonably low level the amplitude of the 50 cps applied to the modulator is relatively low. It can be seen from the symmetry of the circuit that at balance, i.e., when A and B are at the same potential, there will be no 50 cps output from the bridge into the control amplifier.

On the other hand, when potentiometer A is moved, say to give a current flowing in the direction from B to A, diodes M1 and M3 conduct, causing the 50 c/s EMF in transformer T1 to send a current through the centre-tapped winding of the transformer T2, producing an output in a particular phase. Movement of potentiometer A in the other direction, so as to cause a current to flow from A to B, makes diodes M2 and M4 conduct and, as compared with the previous condition, reverses the connection of the EMF in transformer T1 to the terminals of transformer T2. Thus the phase of the output of the voltage from T2 changes by 180 deg. as the direction of current between A and B reverses. Accordingly, the motor can run in either direction depending upon the position of potentiometer B relative to potentiometer A.

The AC output from the bridge is amplified and drives the servo control motor, which will always attempt to keep the bridge in balance. Thus, any movement of the control knob results in an equal movement of the controlled potentiometers as the motor drives the bridge into balance. Coupled to the motor shaft is a generator which produces an output of voltage proportional to the speed. This voltage is fed into the servo ampliifer and so adjusted as to make the whole sytem critically damped. The action is very nearly dead beat giving the operator the impression that the knob is directly coupled to the mechanism which it operates and he has little or no feeling that it may well be many miles away.

The use of DC for the control current has the advantage that for short distances, say of the order of 10 miles,



Schematic diagram of one of the servo units. Basis of the system is a bridge circuit which, when unbalanced at the control point, operates a motor on the camera until balance is restored.

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l/ quality circuits may be used. The stem as installed between Alexandra lace and All Soul's Studio makes use (phantom circuits superimposed on sting speech and music circuits. For iger distances on which a DC loop is r available, it would be necessary to tnslate the control signals to audio quencies, in which form they can be)veniently transmitted.

The control amplifiers are four identil transistorised units capable of givi; a continuous output of 20 watts each. ey are driven from a stabilised 24-volt wer supply. The amplifiers are aight-forward audio amplifiers with itter follower driven Class B output ges, the transistors being OC71, OC71 72 plus OC72 driving 2N268 plus 268. There are two controls, i.e. gain d velocity feedback, thus allowing the formance of any function to be varied will.

The lens fitted has a minimum focus 4 feet with a maximum aperture of .8. The movement of the knurled erating rings required to go from nimum to maximum of all three ictions of the lens is approximately) deg., and the preliminary design led for an operational time of 5 onds end to end. This sets the reduction gear ratio for the servo motor, the lled torque necessary at the motor ft being sufficient to overcome the tion of the mechanism.

OTOR DETAILS

In view of the experimental nature of s camera only two positional servos re used on the lens, i.e. focus and om. The iris is controlled by a nonvo type of small reversible motor of v torque, end stops being used to it travel.

The servo balance potentiometers are unted on the penultimate drive shaft; final drive to the lens is by neoprene thed timing belts. These belts have ilt-in flexible steel wires which pret stretch, the teeth giving positive ve so that a minimum of side loading required and they are silent in operan.

All the connections to the motors, ., are brought out to a multi-way g on the side of the plate. A cover h acoustic damping fits over the ole assembly and also operates as a s hood.

For continuous operation of the nera controls at the remote point, the erator sits at a console on the front which are two knobs; each of these moved in two modes: (a) rotation, (b) e and aft like a lever. On the rightd knob the rotation corresponds to n and the fore and aft motion to tilt; the left hand knob the rotation corponds to focus and the fore and aft zoom. With a little practice, by the of both hands, the operator can conl all four functions of the camera oothly and comfortably.

It was soon apparent that to give ooth control, some form of damping the control levers was required, and s is provided by discs immersed in a cone fluid rotating in a close-fitting mber. The physical operation of each these controls turns the potentiometer ich forms part of the bridge of the propriate servo mechanism.

Because the setting of any of the nera functions can be represented by position of a potentiometer, by anging to switch to groups of potenmeters, it is possible to feed the camera with a number of pre-set "shots." For example, Shot No. 1 might consist of a general view showing two people in conversation, Shot No. 2 would then be a close-up of the interviewer and Shot No. 3, perhaps, a close-up of the person being interviewed. On the operation of a push-button, the camera can be made to take up any of these shots at will.

This leads to the possibility, in studios where the program is of a preset nature, of using say, two remotely controlled cameras which look in turn at the appropriate "shots" under the control of the vision operators in the con trol room without the need for studio cameramen at all.

To pre-set any particular shot, it is only necessary to adjust the corresponding potentiometers for pan, tilt, focus and zoom, there being a group of four such potentiometers for each shot required. On the experimental camera the four positions on the "shot-box" control have proved adequate and useful. Visitors to one of the BBC stands at the Earls Court Radio Show had the opportunity of manipulating a camera in this manner. ("Wireless World.")

PHOTOCELLS AID GYRO SYSTEMS

The Hoffman Electronics Corporation (U.S.A.) announce a new engineering application for their silicon photovoltaic cells, which solves the problem of measuring angular motion without introducing errors due to restraining torques. It should prove particularly useful in servo-gyro guidance systems.

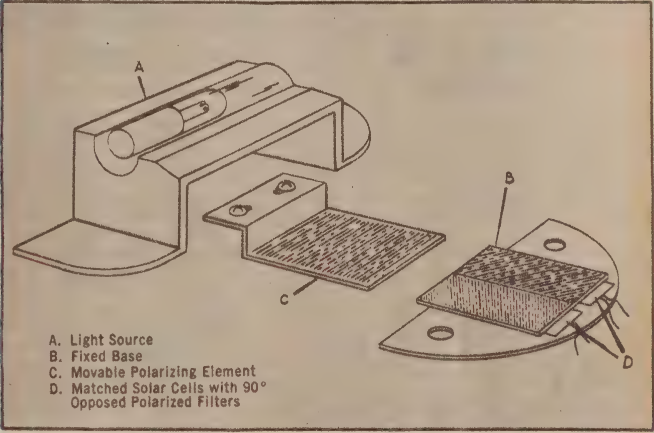
THE Martin Company, of Orlando, Florida, now uses Hoffman photovoltaic cells in a system which can measure the angular deviation of a servo-gyro guidance element. Prior to this development, other sensing systems were capable of causing a small error in the gyro itself which would increase with time. Such an error might be the cause of a system failure.

The heart of the new photovoltaic sensing device is a fixed light beam focused through a movable polarisation element. This beam then strikes two fixed solar cells, each of which has a polarised filter in 90 degree opposition. The movable polarisation element is oriented for a null angle of 45 deg. with both cells.

When the movable element is at the null, there will be no voltage output from the circuit since both cells are equally iluminated. However, any angular deviation from the null will result in an unbalanced distribution of cell illumination, producing a reference voltage which can be interpreted as an exact indication of the angle of deviation.

In Martin's application, the movable element is affixed to a servogyro. The most important single feature of the system is that there is no loading of the gyro itself due to measuring. Previous systems could have introduced cumulative errors due to the reactive measurement energy loss.

The photovoltaic cells are ideally suited for such applications. They are capable of operating under a wide range of temperature and other environmental conditions. Since they are a self-generating device, they need no external bias supply for proper operation.


A
B
C
D
A. Light Source
B. Fixed Base
C. Movable Polarizing Element
D. Matched Solar Cells with 90° Opposed Polarized Filters

The physical principle underlying their operation does not involve any depletion or "wear-out" factor, so the output will remain constant throughout the life of the device. The actual current output of the photovoltaic cells, under short-circuit conditions, is directly proportional to illumination level.

Silicon photovoltaic cells are available in a wide range of sizes and electrical characteristics. The output impedance of these cells is such that they may be fed directly into a transistor amplifier with no complicated matching circuitry. Any electrical characteristic, or combinations of characteristics, may be matched for a given quantity of cells, greatly simplifying balancing circuits.

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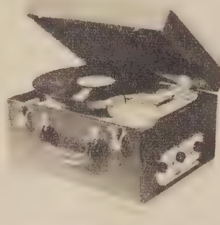

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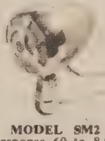

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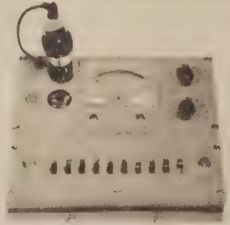

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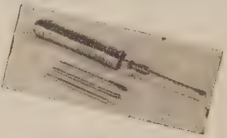

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DUMMY HEAD AIDS RESEARCH INTO SOUND DIRECTIVITY

Research in the field of sound can take on some rather peculiar twists. The setup shown on this page was devised to explore the mechanism by which we determine the direction of sounds. Knowledge of this nature can be very useful in studying stereophonic sound systems, and in determining their effectiveness. The accompanying article was written by R. L. Han-on of the Bell Telephone Laboratories, and reprinted from "Electronics World."

THE dummy head (variously called "Oscar" and "Roland") serves a special purpose in these experiments. A microphone is located in each of his ears. The microphone, in turn, is connected through a network to the corresponding headphone on the subject's ear. Fig. 1 shows details of this arrangement.

Sounds picked up by "Oscar's" microphone can be amplified, shifted in phase, attenuated, or processed in any desired manner by the networks before being fed to the subject's earphones. This provides great flexibility in performing experiments.

efore using "Oscar," tests were conducted on various subjects to see how closely they could determine the direction of a sound. The tests were carried out in the "dead room," or anechoic chamber, with a setup somewhat similar to that shown in Fig. 2A.

en loudspeakers were arranged on an arc of a circle from straight ahead to 45 degrees to the right. The subject's head was clamped in place. One loudspeaker at a time was switched on and the subject was asked which speaker was in operation. For this test, the sound source was a sine wave with a frequency of a few hundred cycles per second. This was applied to the speaker with a smooth rise and fall time of three seconds.

ACCURATE OBSERVATION

he subject had little or no difficulty in selecting the correct speaker for the sound source even though the speakers were quite close together and the subject's head was clamped firmly. He was seldom more than one speaker off, and usually selected the correct speaker.

ext, "Oscar" was introduced into the experiment as shown in Fig. 1. Networks A and B were carefully matched and adjusted in gain and phase so that the signals at the headphones matched that of the microphones. "Oscar" was clamped to the subject's head and moved with the subject. With this arrangement the subject had little or no difficulty in accurately locating the operating speaker.

Oscar" was then removed from the subject's head and clamped rigidly. The subject, sitting nearby, heard via earphones, the sounds picked up by "Oscar's" microphones. This seemed to move the apparent source of the sound away from the loudspeaker and into the headphones. Some sense of "sideness" remained, however, as the sound would seem to be more at one ear than the other.

[redacted]

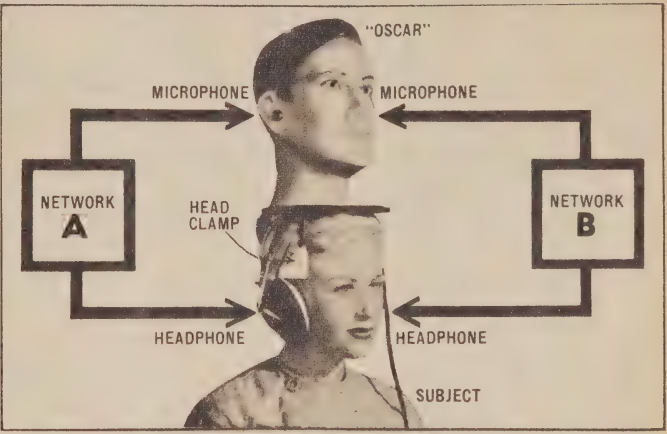

Fig. 1. Experimental set with dummy head clamped to subject's head. Subject's head may be clamped or left free to move, according to nature of experiment.

This test indicates that tiny movements and tremors of the subject's head are necessary in order that the source of the sound appears to be external. Even with the subject's head clamped as securely as possible, such tiny movements take place and succeed in "externalising" the sound source.

If such movements are non-existent, as with the securely clamped dummy head, the "externalising" effect does not take place. When the movements were present, the small changes in relative amplitudes and phases of the sounds striking the two ears were sufficient to provide external localisation.

As a follow-up to this experiment, the subject with "Oscar" attached to his head was placed in front of a loudspeaker emitting a sine wave (Fig. 2B). Then networks A and B of Fig. 1 were adjusted so that the sounds reaching the subject's ears had amplitudes and phases corresponding to a sound source at some particular angle to the side. The subject got a clear and accurate sensation of a sound source at just such an angle.

To carry the experiment further, networks A and B (Fig. 1) were adjusted in such a manner as to violate the natural relations between relative amplitude and relative phase. This caused the sound source to appear diffused rather than sharp and led to large errors in identifying the true location of the source.

REVERBERATION TESTS

An arrangement of loudspeakers, as shown in Fig. 2C was then set up in a reverberant room (Arnold Auditorium) with a reverberation period of about one second. Various speakers were actuated with a sine wave, and observers were asked to state from which speaker the sound appeared to be coming. The observers were free to move their heads and, even so, were unable to name the correct speaker with any degree of consistency.

The auditorium results arise from the fact that the relative amplitude and relative phase of the sound varies from point to point in the room, due to reflections. Thus, the subject has no accurate information on which to judge direction.

These results are based on a sinusoidal sound. Results are quite different for other sounds such as speech, music, and clicks. Such sounds can be located quite accurately, even in a reverberant room.

(Continued on Page 39)

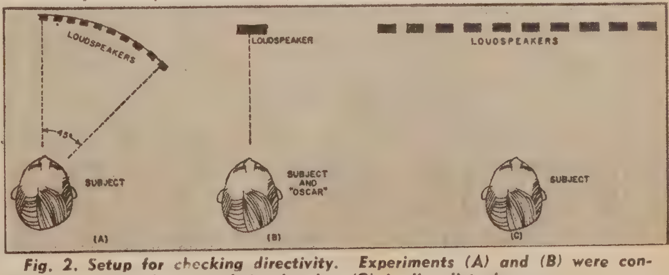

Fig. 2. Setup for checking directivity. Experiments (A) and (B) were conducted in anechoic chamber (C) in live listening room.

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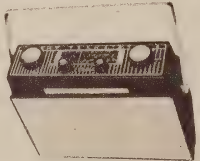

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6G8G	**17/3**	VT116	**5/**
6SK7	**17/11**	6ES8	**14/**
6V6GT	**13/6**	6J6	**19/1**
6X5GT	**12/**	6S7GT	**20/11**
1T4	**12/5**	6G6G	**19/2**
1U5	**12/5**	6K7	**18/4**
1U4	**12/5**	6L6G	**19/11**
6AR7GT	**17/3**	6J8G	**25/11**
VT107	**5/**	6M5	**13/1**
1R5	**13/5**	6F6G	**15/9**
6SS7	**16/6**	6SH7	**16/7**
6AD8, 6AM5	**13/10**	25BQ6	**22/2**
EL91	**16/6**	EBF35	**17/3**
42	**15/**	EB34	**17/8**
75	**14/**	EF37A	**21/3**

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4.7 meg. B.T.A. Carbon	+20%	— 3/6	Dozen
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SCIENTIFIC & INDUSTRIAL NEWS

MEASURING SHAFT SPEED

YSTEM for measuring the speed f a rotating shaft without apply- load, which might affect the speed ation, has been developed.

Ir many cases it is not possible to k a direct physical connection with haft. An electro-magnetic trans- ce device is of use in such circum- ns.

A advantage of this device is the hat it has itself no moving parts. e whole system is encapsulated in py resin. It can be used to measure otation of any shaft containing rs material.

In operation, the poles of the electro- gt are placed close to the rotating and any lack of uniformity, or any larity in the iron-bearing material, us a pulse to occur in the output cir- it f the device. These output pulses n fed into any suitable type of elec- on coupling device either after in amplified or without being ampli- d.

[lectro-Mechanical Division Re- an Laboratories, Ericsson Tele- os, Beeston, Nottingham, England.]

IACHINING METALS

PARATUS which will measure ac- urately the time a metal compo- n is actually being subjected to the ti of a machine tool has been de- e by a Swedish firm.

Te device operates by measuring the eropotential generated at the tip of e ool cutting the metal. Thermo- ot tial arises when two dissimilar ets (in this case the component being ained and the tip of the tool) rub ast each other, or when the tool cuts to the metal. Heat is generated and e wo metals then act as a thermo- ue, the heat causing an electric cur- n to flow. The time during which is current flows is proportional to the ai ining time.

[elefonaktiebolaget L. M. Ericsson, o holm 32, Sweden.]

THICKNESS MEASUREMENT

A NEW thickness sensing device de- signed for measuring the thickness ielectric materials by using micro- a's is said to have shown that an ccacy of thickness measurement of to it n plus or minus 0.00014 inches can peatedly obtained.

fully automatic instrument of rug- ec construction can be produced for se under normal workshop conditions.

I operation depends on the use of secial microwave bridge system. The eurement quoted is continuous so a any changes which occur in a mov- ng trip of plastic of similar material ar be accurately recorded.

[ristol Aircraft Ltd., Subsidiary of riol Aeroplane Co. Ltd., Filton de, Bristol, England.]

FAULTY INSULATION DETECTION

TRANSPORTABLE equipment for the detection of faulty insulation in electrical equipment in ships, and removal of moisture causing failure, is now on the market.

Consisting basically of a low potential supply of drying current which is passed through the cricuit with the faulty insulation, this equipment is fitted with voltmeter and ammeter to indicate the voltage applied and the current flowing during the drying-out process.

The correct drying current for a particular size of cable is chosen from a table supplied. As the temperature of the cable rises, any moisture present moves towards the end of the cable and evaporates.

[Marine Department, A.E.I. Telecommunications Division, Woolwich, S.E.18, England.]

ELECTRO-PLATING

ONE of the problems arising when electroplating components are made from powdered metal is that of sealing off the minute pores which are left when the part has been formed. It is now being claimed in Hungary that metals such as chromium and nickel can be electrodeposited on to powdered metal components quite successfully if the latter are subjected to an atmosphere of superheated steam, thus coating it with a layer of iron oxide which prevents the inner structure from chemical attack by the plating metal.

It is reported that the electro-deposited coatings then adhere very firmly and that the usual intermediate layer of copper is no longer necessary.

[Altalanos Geptervezo Iroda, 2 Kuny Domonkos Utca, Budapest 5, Hungary.]

MELTING PROCESS

METALS, semi-conductors and ceramics can now be melted and refined on an industrial scale by means of a recently developed technique which involves directing a beam of electrons on to the material contained in a special chamber.

A German firm which started up one of the first electron beam melting plants has reported that many of the teething troubles associated with this process have been overcome. In particular, only an insignificant portion of the gases involved during melting now finds its way back into the chamber and the process therefore no longer has to suffer intermittent interruptions.

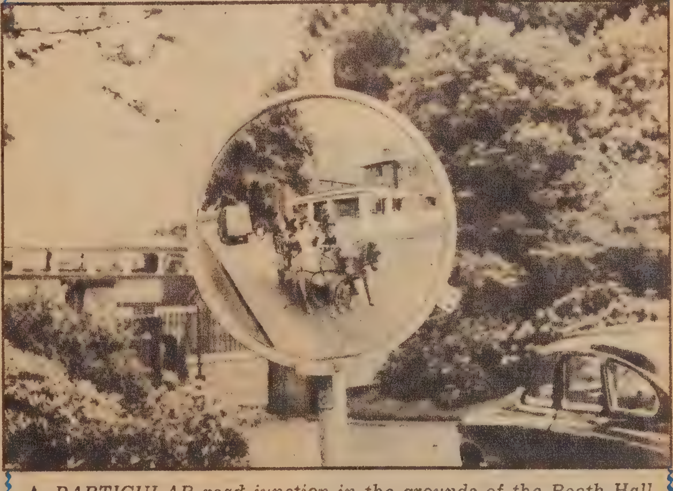
[W. C. Heraeus, Waldstrasse 12-14, Hanau 369, Germany.]

BURNING IT OFF

AN electric shaver which has no cutting mechanism but burns the whiskers off instead has been patented in America.

The shaver is powered by a low-amperage current at 600 to 800 volts

NOVEL SAFETY FIRST PRECAUTION



A PARTICULAR road junction in the grounds of the Booth Hall Children's Hospital in Manchester, England, constituted a serious traffic hazard. Authorities solved the problem by erecting this large mirror in a position where drivers could see approaching vehicles. Reflected in the mirror is a pony-trap which takes the children for rides, every day, around the hospital grounds.

Taylor meters

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72A. A 1,000 o.p.v. meter for use where higher accuracy is essential. Measures to 750V A.C. and D.C., to 1,500mA A.C. and D.C. (plus 0-15A DC.) and to 500K ohm. Sensitivity plus or minus 1.25% D.C., plus or minus 2.25% A.C. Incorporates buzzer for continuity tests.

PRICE: £33/16/
plus Sales Tax.
F.O.B./F.O.R. Sydney.

77A. A general purpose multimeter with higher sensitivity (20,000 o.p.v.). Measures to 3,000V D.C., 750V A.C. 1,500mA D.C. and 15A D.C. and to 50 Meg. Incorporates buzzer for continuity tests.

PRICE: £29/18/
plus Sales Tax.
F.O.B./F.O.R. Sydney.

88A. An extremely comprehensive 20,000 o.p.v. multimeter. Measures A.C. and D.C. voltage to 5,000V, A.C. and D.C. current to 10A, resistance to 50Meg, decibels, capacitance to 100uF, inductance to 20H. Buzzer incorporated for continuity tests.

PRICE: £44/4/ plus Sales Tax.
F.O.B./F.O.R. Sydney.

88B. Specifications very similar to those of 88A but appearance almost identical to 105A.

PRICE: £44/4/ plus Sales Tax
F.O.B./F.O.R. Sydney.

105A. A 20,000 o.p.v. bench or portable multimeter. Measures to 1,200V A.C. and D.C., 12A D.C., and 20Meg. Accuracy plus or minus 3% A.C., plus or minus 2% D.C. ranges.

PRICE: £32/10/
plus Sales Tax.
F.O.B./F.O.R. Sydney.

127A. An inexpensive pocket-sized multimeter with a sensitivity of 20,000 o.p.v. Measures voltage to 1,000V A.C. and D.C., current to 1A., resistance to 20 Meg. Also has 5 decibel ranges. Accuracy is plus or minus 3% on D.C., and plus or minus 4% on A.C.

PRICE: £14/19/
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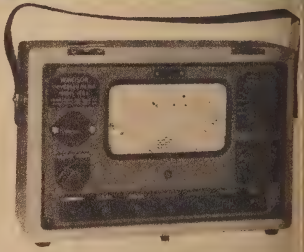
Leather cases are available as optional extras.

All instruments carry the full Jacoby, Mitchell Guarantee.



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is fed to alternate metal teeth in ing head shaped like a comb. The are spaced .003 to .005in apart those that are not charged are d back to the transformer.

en the shaver is switched on very electric arcs are caused between eth and as it passes over the face ard is burned off. It is stated that tion keeps the current from reach- he skin and that there is little or ating of the shaver itself.

arry J. Hobbs, 6220 N. Meridian Indianapolis, Indiana, U.S.A.]

YPE FACE ADAPTOR

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e adapter fits on to the typewriter he plastic type faces go into it. The ng is actuated by any spare key on nachine. Some 400 different sym- are available.

echanical Enterprises Inc., 3158 son Davis Highway, Arlington, nia, U.S.A.]

MAKING POWDERS

ALL automatic grinding machines for laboratories now being offered electrically powered, and fitted with g devices so that after being filled the material to be pulverised they be left to work on their own.

ch machine has a pestle and mortar porated in it, pressure on the pestle variable up to a maximum of . The maker says that all kinds of rial—including samples of metallic ders, pigments, glass, ceramics, nt and pharmaceutical products— be ground up by the machine to lytical fineness."

lfred Fritsch, Hauptstrasse 542, -Oberstein, West Germany.]

EING WOOLEN CLOTH

PROCESS for colouring woollen cloth—described by the National ciation of Scottish Woollen Manu- urers as the first major breakthrough extile colour and design technique 50 years—has been introduced by a tish tweed manufacturer.

his process enables 30 or 40 different urs or shades to be incorporated in fabric. Normally only seven or t individually coloured threads may woven together into one pattern but , claims the originator, each thread be dyed in five or six colours and total number of colours used can be tiplied as required.

olourcraft (Gala), Galashiels, Scot- .]

MINOUS STEEL SHEET

ALLS, ceilings, stairs, motor car and aircraft instruments can be illumi- d by a new type of steel-coated e.

he system depends on a newly deve- d electro-luminescent compound in form of a coating to steel sheets. The em operates without any need for s, tubes or other fixtures and the nt of light emitted can be precisely trolled by means of different types thicknesses of coating.

At present the technique has been developed using steel as a base for the coating. The coating could be applied to a wide variety of different metals. The light provided is completely uniform and moreover does not create large numbers of unwanted shadows. The elements are exceptionally rugged and long-lasting.

[Sylvania Electric Products, Inc., Dept. 51, 60 Boston Street, Salem, Mass., U.S.A.]

SMALLER INDICATOR LAMPS

A NEW indicator lamp is manufactured almost completely of glass and is considerably smaller than the smallest indicator lamps hitherto available.

The lamp, which is to be manufactured in 6.3 and 12 volt form, has a wedge-shaped base and can, therefore, be plugged in simply with a push. The socket for the lamp is so designed that it can be readily moulded into plastic circuits, and as a result can easily be used for systems manufactured by automation techniques.

Since it has no basing cement the lamp can withstand continuous temperatures of up to 600 degrees Fahrenheit.

[General Electric Co., Research Laboratories, Schenectady 5, New York, U.S.A.]

WRAPPING 100 TYRES AN HOUR

NOW in production is a new machine for wrapping scooter, mini-car and motor-cycle tyres.

The machine uses a hard chrome plated-steel shuttle revolving at about 200 r.p.m., giving wrapping times of from 7 to 12 seconds, according to the size of the tyre. An efficient operator should be able, it is claimed, to wrap from 800 to 900 tyres of assorted sizes per eight-hour shift.

To give added strength to the wrap, the shuttle is provided with an edge-folder which folds the paper while wrapping. By means of air-operated rollers, the beads of the tyre are compressed when the machine is started and released when it is halted.

Powered by a 3-h.p. motor, the machine is started and stopped by either foot pedals or a hand lever.

[Norbury Engineering, Hyde Cheshire, England.]

PLASMA TORCH

A NEW plasma torch is said to be of exceptionally simple construction and to be capable of reaching temperatures of up to 20,000 degrees Kelvin.

The device uses only three kilowatts of electric power. Furthermore, the high temperature region produced does not occur merely at a point of focus. The system is therefore particularly useful for the carrying-out of materials processing or of experiments with materials.

The torch is designed so that no contaminating combustion products are produced and it can be operated with any desired single gas or mixture of gases. Its operation depends on the use of a special "inductive coupling" system used in conjunction with ionised or electrically charged gas.

[Dr T. B. Reed, Lincoln Laboratory, Massachusetts Institute of Technology, Cambridge 39, Mass., U.S.A.]

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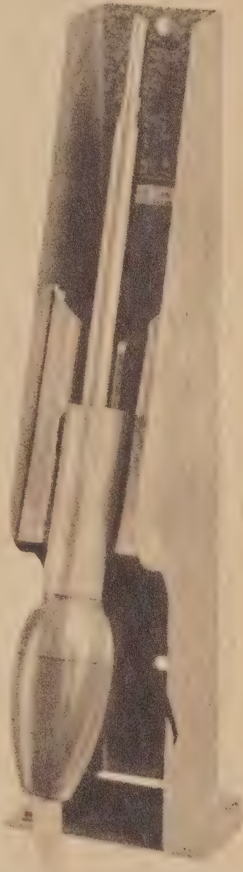

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Printed boards by the dozen—literally. It is unlikely that the average hobbyist will want to work on this scale, but it is typical of mass production techniques. Note the valve type numbers etched along with the wiring pattern.

Make Your Ow
PRINTE CIRCUIT

By
Philip Watso
and
John Davidso

Ever thought of making your own printed circuits? If you imagine this is beyond the scope of the average hobbyist you are in for a pleasant surprise. Not only is the process simple, but materials are readily available at a reasonable cost. This article describes both commercial practice and a simplified technique for the home constructor.

MOST people tend to think of printed wiring in terms of large-scale mass production, fully automated production lines, dip soldering, etc., and as being completely outside the scope of the home constructor.

On the other hand, there are so many advantages in this technique, whether in the production line or on the kitchen table, that it is worthwhile considering any system which will allow the home constructor to make his own. Given a proven design it is almost impossible to go wrong, not only in regard to the actual connections, but also in the all important matter of layout. This latter aspect is so important that it may mean the difference between success or failure in a home-constructed project.

Many of our readers already are familiar with the technique, since a number of our projects have been designed around commercially produced boards. Typical of these are various sets in the "Transporta" series.

NOT ALWAYS AVAILABLE

Unfortunately, commercially prepared boards are not always available, and the question then arises as to whether it is practical for the home constructor to prepare his own boards. We are hopeful that it will be, at least to the extent that if we publish a design, the individual should be able to copy it and to etch his own board.

Alternatively, he may even be prepared to produce his own design right from the beginning. While not always a proposition for a single copy, there are plenty of cases where it can be justified, particularly where the simpler designs are involved.

One point to be clarified before we proceed further is the rather fine distinction between "printed circuits" and "printed wiring." While this may not matter a great deal in everyday conversation it is worth noting that "printed wiring" means just what it says; an assembly of more or less conventional components connected together by printed wiring as distinct from the normal hookup and tinned copper wires.

ADVANCED TECHNIQUE

"Printed circuits," on the other hand, refer to a rather more advanced technique. In addition to the wiring, many of the components are "printed" by the same or similar processes. Resistors, capacitors, and inductors may all be produced on the wiring board, even though with rather severe limitations in the case of the last two.

Because these techniques are rather specialised, and because of the limitations mentioned, they are usually reserved for more specialised applications. For everyday applications, such as domestic radios, etc., printed wiring plus conventional R, C and L components, appears to be about the most economical compromise.

While there are a wide range of methods which may be employed to produce printed wiring, and which have particular advantages in certain applications, the one we intend to discuss in this article is by far the most commonly used in the electronics industry.

This uses a sheet of insulating material, normally paper laminate (sometimes called "punching bakelite"), to has been bonded a thin coating o per. By any one of a numb methods, the required pattern is ferred to the copper in the form etching "resist" so that, upon etchin copper is completely removed in a the protected portions. This leav original pattern traced in copper.

Subsequent processes consist of ing with liquid flux (which also to protect the copper pattern fro nishing) drilling and punching to a modate the components, and p printing essential information on t verse side to facilitate assembl servicing. After that, the board m stored for any reasonable time ur quired.

VARIED SPECIFICATIONS

The copper clad board is av in a wide variety of specificatio cluding the base material, base ness, copper thickness, etc. The popular grade is 1/16in paper la copper coated at the rate of 1 square ft. This represents a thickness of .0015in.

The base material is availa thicknesses up to ¼inch, where tional strength is required. Altern it is also made in woven fibregl thicknesses from 1/16 to 1/8in material has the advantage of stronger than bakelite for a weight, more heat resistant, an hygroscopic. Base material can a supplied coated on both sides, w sometimes required in more spe applications.

Copper weights range from 1 square ft up to 6oz per square the possibility that even heavier up to 9oz, may be available future. Normally, however, 1oz grades are adequate, the current on the latter being quoted as 15 continuous for a ¼inch wide tra

Probably the most interesting of printed wiring is the man which the required pattern is pro Some of the processes are quite ed, though justified for various r and this has lead to the comm lief that there is no simple meth which an individual can produc off" for experimental purpose or a given design.

point of fact, it is quite simple to ce "one off," and this is done re- lly in laboratories, mainly in the s of evolving a practical design to going into mass production. By ng the right system, we may eco- ally produce "one off" for prelim- testing, a "few dozen off" for a roduction run, or "thousands off" e full scale run.

bably the most popular method of cing large quantities economically silk screen process. Although it ppear involved from the home con- or's point of view, it is a com- vely simple and economical process factory basis.

ARGED DRAWING

normal starting point is a larger- ife drawing of the final pattern, is photographed onto a prepared creen, and reduced to the required n the process. On processing, the screen becomes a stencil, exactly r to the silk screens used in many of printing and art work, with por- of it "transparent" and "opaque," ng these terms in the physical rather he optical sense — according to the al pattern.

use, the screen is held in close con- vith the copper coating and a suit- resist paint applied to the screen a squeegee. The paint is forced gh the "transparent" parts of the thus transferring the pattern, in to the copper. The plate is now for etching.

can be appreciated, this process is y suited to large scale production. the silk screen is produced, repro- on is a purely mechnical process does not involve complex equip- or highly skilled personnel. Boards roduced quickly and, where very quantities are involved, one screen contain several repeats of the same n, thus cutting down handling at al stages.

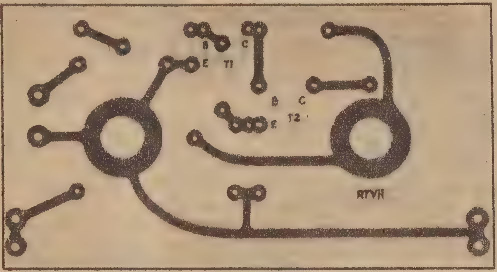
hough silk-like fabrics are used for "silk" screens, a very fine mesh of ess steel wires is sometimes used for quality work.

DETAIL

wever, the silk screen is not with- ts disadvantages, the main one is he fineness of detail is restricted by esh of the fabric, even though the pattern is not visible as such in the ed article. This restriction is not s in everyday working, involving ntional printed board patterns, but be so in the more specialised es of miniaturisation and micro- turisation.

r this type of work, for small oduction runs, or full scale runs rtain sizes, the photo-etch process ost suitable. Although not as and simple as the silk screen ss, it has the advantage that the ess of details is limited mainly by the etching process, making possible the etching of very fine lines if necessary. It is also more likely to appeal to the advanced amateur or hobbyist as being within the scope of photographic materials and facilities likely to available.

Once again the starting point is a larger-than-life drawing, but this time it is photographed directly onto the copper surface. To sensitise the copper surface it is coated with one of a number of preparations similar to those used in photo-lithography or photo-engraving.



***Before.* The copper clad laminate prior to etching, with the pattern picked out in resist paint. Note the nature of the pattern where holes for pigtails, eyelets, etc., are to be drilled. Even if your pattern isn't as neat as this it will still work.**

These are known as photo-resists and, although differing in detail, all have the same general characteristic in common. This is that, upon exposure to light (and perhaps subsequent development processes) they become insoluble in certain solutions, but remain soluble where the light has not reached them.

PATTERN REMAINS

Thus, after exposure, the plate is processed and the unexposed resist washed away, leaving the pattern picked out in the harder exposed material. In some cases the resist may be adequate as it is; more frequently it is necessary to impregnate it with other substances and possibly bake it or "burn it in" to render it completely resistant to the etching solution.

Finally, we come to the simplest process of all; the preparation of the pattern by hand, using a conventional artist's brush and suitable resist paint. Naturally, such a scheme has no future in quantity production, but it does have its place in the laboratory. Here, where the first rough draft of a board is produced, it can be used to produce the first copy for testing, or to modify a pattern produced by any of the other methods.

Even more important from the hobbyist's angle, it may be used to produce single copies of experimental boards, either concocted by the hobbyist himself, or copied from published designs. It is this angle we wish to discuss this month.

We are also hoping to work out a photo-etching technique which is within the scope of the advanced hobbyist, and which will also make it practical to copy published designs. Assuming we can solve all the problems of material supply etc., we hope to discuss this aspect next month.

In the meantime, we will concentrate on the hand-painted technique, remembering that the etching and other after processes will be the same or similar, regardless of how the pattern is produced.

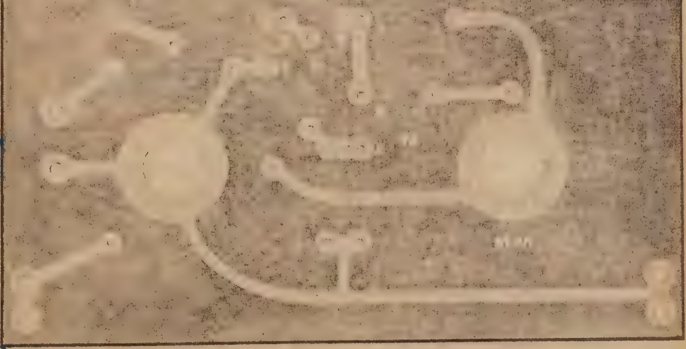
The first point to be considered is the actual preparation or planning of the required pattern, and it might be just as well to point out right now that, where a large and complex circuit is involved, this can be quite an exacting task. Even if it is not actually beyond the scope of the home builder, it may well require much more time than is justified for "one off"

On the other hand, there are many projects which are well within his scope, particularly if he is prepared to aquire experience on simple ones for a start, progressing in easy stages to something more involved.

TYPICAL BOARD

The simple board we have used to illustrate this article is a case in point. Designed around the elementary two stage transistor amplifier described elsewhere in the magazine, it is intended mainly as an exercise. To be sure, it makes a neater job than the original design, as well as reducing the chance of mistakes to an absolute minimum, but it

fter. The same board after ching and with the resist paint moved. This picture is exactly ght size and the pattern may traced from it onto a copper rface using ordinary pencil rbon paper. Note the use of entifying letters to assist in sembly and the relatively fine nes in the "RTVH" monogram.



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ubtful, whether it represents any al saving of time or effort.

Te real point is that, having tried s and at something like this, the exper enter will feel encouraged to pro- to something where printed wiring reents a real advantage over conven- or techniques.

Ce possibility is that he may take xisting design, as the simple fier illustrated, add something to suit his own rements. For ple, this amplier vas taken from hree Transistor iver of March 9 and it is not to visualise the ional (detector) being added to a complete set. other possibility that of copying shed designs. In case the really work will already have been requiring only nore or less ne process to uce the most plicated wiring rn. In these circ tances the printed board becomes attractive as it mes more comle since it is little er to etch a complex pattern than nple one.

ssuming that this idea proves popur we are hopeful of developing our printed board designs, for publica- in the magazine in such a way as nake it relatively simple for the er to print his own boards from . If this can be done, it may well a completely new approach to can be undertaken by the home tructor.

TABLE MATERIALS

e next and most important question e availability of suitable materials. l now there has been no easy way the hobbyist to purchase a few ings worth of any item for experital work. However, one or two of advertisers are now in a position fill this gap. They plan to make lable experimental kits containing rted sizes of board, ferric chloride, t paint, resin etc., in small but usequantities. The cost should be mode and individual items will be avail- for replenishment.

ssuming we have obtained these erials, let us consider how we would about reproducing the simple ampli- board illustrated in this article. t we need to cut a piece of laminate he required sixe of 4½ x 2 3/8in. mercially, this material is cut on a ial guillotine, both the guillotine the material being suitably preed to minimise cracking or splinter- of the base material.

or the home constructor a hack saw a fine blade appears to be the best . The cut should be made from the per side with the blade held flat inst the material, after which any gh edges may be cleaned up with a

Lay the published diagram over the board, with a piece of pencil carbon in between, and proceed to trace the pattern with a medium grade pencil. It is a good idea to fold the page on at least one side and secure everything with a couple of paper clips.

Using both the traced lines and the original drawing as a guide, the pattern is then picked out in resist paint with a small artist's brush. There is no particular skill required here, except that the neater the painted lines, the neater the etched copper pattern. In a simple pattern the width of the lines are not critical, averaging from 1/16 to 3/32in. However, it is necessary to watch the spacing between lines in complex patterns, particularly where high voltages might be involved.

If the resist paint appears to be too thick for easy working it may be thinned with the appropriate thinner. (Mineral turps for bitumen base paint.) Mistakes may be wiped out with a piece of cloth soaked in the same thinner, remembering that it is a good deal easier to correct errors in paint than in copper.

HOLES ETCHED

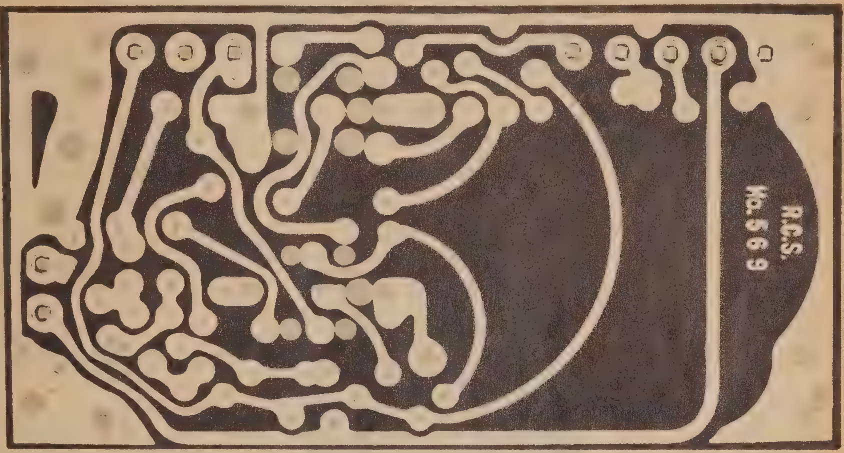
Where holes are to be drilled, an appropriate area of copper should be left bare so that it will etch. This makes the subsequent drilling a good deal easier. Where holes are shown, it is a good idea to transfer the exact hole positions by tapping lightly with a centre punch. This is especially important where they have to match a particular component.

Where a number of pigtails have to be joined to the same point it is normal practice to provide a hole for each, with a copper link between. This avoids undue crowding on the reverse side of the board.

It is quite in order to incorporate identification letters or numbers, or component symbols into the etched pattern provided there is room. Such lettering may be done with a mapping pen using thin resist paint. (Note the "RTVH" incorporated in our own board.)

Having produced a pattern in resist, by whatever means we employ, the next job is to etch away the unwanted copper. In commercial practice the two most popular etchants are nitric acid and ferric chloride. Nitric acid has some advantages, including the fact that it is relatively simple to reclaim the copper from the exhausted bath, but suffers the disadvantages that it gives off toxic fumes and needs very careful handling.

Ferric chloride is much more commonly used. It is relatively mild, easy to handle, and produces no toxic fumes. Another reason for its use appears to be that, because of its mild action, relatively simple resists, particularly photo-resists, may be used without risk that the etchant will penetrate the resist. This greatly simplifies photo-etching techniques.



A typical commercial board designed around one of our projects. Produced by RCS Radio Pty. Ltd. it is for use with the Transporta Four of October 1959. A relatively simple board, it represents a logical "next step" for the beginner. Reproduction is full size.

PRACTICAL MIXTURES

Commercial mixtures of ferric chloride may have other chemicals added, particularly small quantities of hydrochloric acid, but these are mainly refinements. For experimental work a simple solution of ferric chloride in water is perfectly satisfactory.

Ferric chloride is normally sold as small yellowish brown lumps about the size of an almond nut. They are quite hard when dry but dissolve readily in water. The proportion is not unduly critical, but too strong a mixture is likely to work slowly, as well as being uneconomical. Similarly, too weak a mixture will work slowly, meaning that there is an optimum strength.

This is given as four to six ounces of ferric chloride to a pint of water, and we worked on this proportion in our experiments. At a temperature of 75 degrees F we were able to completely etch a plate in 35 minutes. This time will be less at higher temperatures, and some authorities recommend 90 degrees to 120 degrees as a good working range.

On the other hand, the time will increase as the mixture becomes contaminated with copper, and should be discarded when the etching time is twice

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new solution. While commercial ions use elaborate methods of n, it would appear to be suffi- ensure that the plate is com- covered and the dish rocked ally.

photographic dishes, such as bakelite, enamel, stainless steel pear to be quite satisfactory and chosen mainly according to the ates most likely to be handled. tively, for preliminary experi- Pyrex glass bowls or pie dishes e kitchen may be used, provided washed carefully afterwards.

IN WATER

etching, the board should be in water to remove the etchant, abbed with a solvent to remove ist paint. White spirit (X55 etc.) commercially but mineral turps sene could also be used. Where is used, an appropriate thinner better.

his point an experimental board be regarded as finished, but we tail the commercial practice for nefit of those who may be in- . This is aimed mainly at en- proper functioning in subsequent g processes, particularly auto- processes.

main job is to clean the remain- pper, then protect it against tar- until required. Cleaning is done ans of a "bright dip" consisting part hydrochloric acid ("spirits ") to five parts water, usual prac- ing to brush this onto the board.

is followed by a water rinse for inutes, two minutes in a sodium ate solution (about one ounce to llon of water), another two minute rinse, and then a bath in methy- spirit. This latter is mainly to drying, after which a coating of ive flux is applied.

re are many commercially pre- fluxes which may be used but, for work, a solution of resin in ated spirit appears to be adequate. tions are not critical, but about level teaspoonsful to four fluid of methylated spirit makes a good e.

DUE CARE

re the board is to be used im- tely it may be possible to skip eaning process, provided due care en, when soldering, to clean the nt area mechanically and use a solder with an activated flux.

an alternative to the bright dip ve found that a quick rub with polish is an equally effective, if hat less convenient, method of ng the copper pattern.

final step is to drill all the ary holes in the board. Pigtail may be drilled with a No. 60 this being a little larger than 1/32 nd able to accommodate all pigtails lly encountered.

let holes will need to be drilled ding to the type of eyelet used, his factor needs to be taken into nt when the board is being pre- for etching. According to the size e eyelet, so an appropriate area be left for etching and subse- drilling.

re are a number of eyelet types ble, but we used two types originally intended for use with Zepher Matrix. These are Zepher eyelets, type No. 280, and Zepher eyelets with solder lug, type No. 283. A 3/32in drill is suitable for these.

Larger holes, up to about ¼in, may be drilled with a power drill if desired, but beyond this the slower speed of a hand drill is safer. Large holes to accommodate potentiometers etc. are best drilled slightly undersize, then enlarged and trimmed with a round file. Work from the copper side of the board in all cases.

In conclusion, we would like to acknowledge the ready help and co-operation given us by Technico Electronics Pty. Ltd., Australian licencees of Technograph patents, held by Technograph Printed Circuits Ltd., of London.

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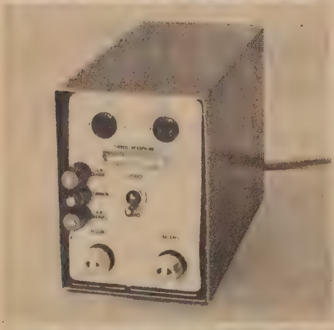

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FROM THE SERVICEMAN WHO TELL

Most of us are familiar with the "simple" service job which turns out to be anything b that, but I wonder what constitutes a record for this kind of thing? In any case the stor I am about to relate is typical, and illustrates just how easily such things can snowba sometimes to embarrassing proportions.

THE story started out as nothing more than the sale of a replacement electrolytic, plus a few words of helpful advice about what appeared to be a most elementary fault. It finished up as . . . well, perhaps I'd better take it step by step.

The owner appeared to be a typical handyman cum do-it-yourself type who, while not claiming any great knowledge of radio, did appear to have enough to cope with a simple routine fault. He had access to a multimeter, apparently knew how to use it, and had at one time built himself a couple of simple amplifiers.

OLD RADIOGRAM

The set in question was a radiogram of somewhat doubtful origin, long since pensioned off from the lounge-room, and now serving as a second set in his workshop. In spite of its age—or perhaps because of it—he seemed to have a sentimental attachment for it rather out of proportion to its true worth. But then, that is not really unusual.

The problem, according to the owner, appeared to be a broken-down first electrolytic in the power supply, and he simply wanted to know whether his diagnosis was reasonable before investing in a new capacitor. His story was that the set had failed, the rectifier (an 80) had given forth "sparks and blue lights," and measurement with the ohmmeter had shown only a few hundred ohms across the first electrolytic. Did I think this was the trouble?

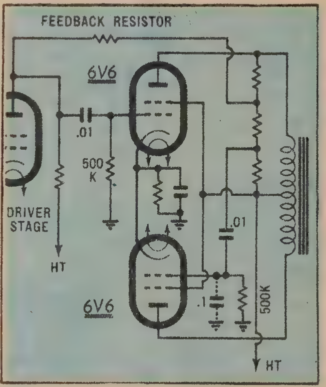
I said I thought that it was a reasonable diagnosis, but pointed out that it was not conclusive. For one thing, many ohmmeters present a test voltage opposite to that indicated by the lead markings; this can cause an electrolytic to read lower than normal, while still quite good. Again, the "few hundred ohms" could be in the filter system, the true fault being a dead short further along the line, such as the second electrolytic.

He hadn't considered the last point, but the problem of ohmmeter polarity had been overcome quite simply—he had tried it both ways. Since both had read the same it did seem that this really was the trouble. In any case it seemed worthwhile to take a new electro on spec., which he did.

I took the opportunity to suggest a new 80 as well, pointing out that the present one must have taken a pretty solid beating and might have succumbed. However, it seemed that he had a good spare on hand, so that was no problem. He took his leave and I promptly forgot about the whole thing.

A few days later he was back in the shop, obviously worried. After he had refreshed my memory about the original fault, he went on to describe how he had replaced both the first electrolytic and the 80, and the results he had obtained. The set still refused to work and, shortly after switching on, the first electrolytic had become very hot and belched forth white, acrid smoke.

The owner seemed completely demoralised. He had no desire to tackle the job again; all he wanted to know was whether I would take on the job for him, in spite of its age and, I gathered, being a "bit of a bomb." While not particularly keen on such jobs, one customer's money is as good as another's and few of us can afford to be too choosey. I said O.K., and he was quite happy to deliver the chassis to the shop.



The circuit as I found it. It represents a fairly conventional paraphase arrangement, except for the .1 mfd capacitor (dotted) from the lower 6V6 grid to chassis. This was a foreign component, apparently added to control oscillation.

In spite of what I had been told I must admit the thing gave me a bit of a shock when I saw it. It was very old, and obviously home-made, but by whom or to what design was not known. It used a pair of 6V6s in push-pull, and a fairly conventional front end consisting of 6J8, 6U7, and 6B8. Judging by the type of chassis, dial, and other components, I would place the vintage as the early 1940s.

But it was the wiring that was the biggest shock. It was a proper rat's nest; a motley collection of components—seemingly dropped in wherever there happened to be some spare space—were strung together with sloppy lengths of hookup wire. In several cases they were correctly terminated at one end only, the other ends forming a "mid-air" type of connection of several pigtails and a blob of solder.

My first check was on the rectifier. The fact that a new electrolytic had behaved as it had suggested that it might have had AC applied to it. Sure eno test in the valve checker showed between one plate and heater, this confirmed with the ohmmeter and sured as a virtual "dead short."

So that was the solution to tha tery; a coincidence of two faults same part of the circuit, first a electrolytic which destroyed the re then a faulty rectifier which destro electrolytic. I don't know what th would be against such a combinati they must be pretty long.

I took a closer look at the e lytics. The first one would need replaced for obvious reasons, whi remainder looked old enough an enough to warrant the same trea as a matter of course. This inclu couple of 25 mfd cathode bypasses

That done, I switched on and w the (new) rectifier carefully while warmed up. While I assumed th original trouble had been due electrolytic, it could easily have voltage breakdown elsewhere, and not keen to see another 80 go blue lights. So I kept my hand main switch until everything had down.

In fact, everything seemed to normally. The radio section b quite well, the audio section see have adequate sensitivity, and the q at normal room volume, was quite

At this point, apart perhaps fr alignment check, I normally woul given the thing away, if only basis that the less one disturbed better. However, I was now suffi familiar with the circuit to be int by what appeared to be a straig contradiction of conventional cir namely, a .1 mfd capacitor fro of the 6V6 grids to chassis.

GENUINE CIRCUIT?

Now I know there have been strange audio circuits cooked up past, and I don't pretend to be c sant with them all, but I found i to accept such a set-up without qu As far as I could remember, th circuit which ever used such an ar ment was the famous—or infan Barnes Mystery Circuit. (Which really a mystery.)

Thus intrigued, I set out to tra portion of the circuit to see if it sense. It wasn't easy in the h hookup, but I eventually managed the essentials down on paper. Bas it appeared to be a form of par system which was popular some ago. In general terms, the "lower" of a push-pull pair derives its from a tapping on the plate lo the "upper" valve. In this case from a voltage divider across th half of the speaker transformer.

All of which was fairly straig ward, except that the lower 6V which was destined to receive this geniously derived driving voltage, e one which was so effectively d with the .1 mfd capacitor. As I could see it would receive very gnal.

ais point I had to decide whether mponent really did represent a subtle form of circuitry than I ble to appreciate, or whether it nply a "bodgie"; a ring-in com- added by someone who had only guest idea what he was doing. dn't take me long to decide. By tch of the imagination could its n the circuit be justified, leaving ond suggestion as the only logical

why had it been added, and by

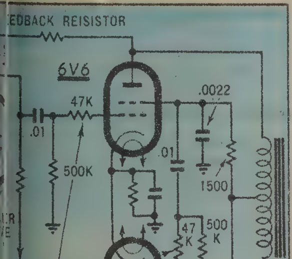
AUTION

this point I took the precaution tacting the owner and advising at the job looked like going beyond nple power supply fault. He was agreeable for me to go ahead, stating that he would leave it discretion not to let things get hand.)

way to investigate was by re- g it and noting what happened, his line of thought immediately ed a possible reason for its pre- The most likely thing to "happen," undesirable nature, was oscillation, y supersonic. Had someone adop- ch a drastic measure to cure a ike this?

vasn't hard to find out. I hooked RO across the voice coil and lifted arthy end of the .1 mfd. Sure n, the CRO pattern spread out a line to solid rectangle. It was ting all right, and well up in the onic region. So that explained the nd, but what a way to cure insta-

the circuit stood it wasn't even d single-ended arrangement. About nly advantage was that the DC current of the lower 6V6 was still g in the transformer primary, ef- ely cancelling its equal and opposite rpart in the upper half. At least ansformer was working correctly in this respect, and possibly better than a normal single-ended type.



e circuit as it finished up. This m of push-pull is fundament- y more stable than the previous rangement, as well as being pler. Additional modifications re the fitting of grid stoppers d careful selection of a bypass the driver plate to control ringing.

Otherwise it was half a push-pull circuit rather than a properly designed single-ended one—the two conditions are not the same—with half the power supply and one output valve going to waste.

The next point was, what to do about it? Was the oscillation fundamental to the circuit, or had something slipped in an otherwise stable arrangement. I had no way of knowing, of course, but the more I tried to cure it the more convinced I became that this was no simple "component failure" problem.

Nothing I tried seemed to have the slightest effect. I had rather imagined that a layout as haywire as this one would provide ample scope for improvement; a long grid lead too close to the output circuit, a component poorly placed, or something of a like nature would surely be the answer. But it wasn't. I went over the circuit and corrected every likely fault of this kind without result.

I even changed the 6V6s, temporarily shielded them, earthed the speaker frame, and tried other similar tricks. Nothing had the slightest effect. It was becoming more obvious than ever that it was a design weakness. It also explained why someone else had taken the easy way out with the .1 mfd.

At this point I remembered a colleague who had had rather more experience than I with sets of this vintage, and I immediately sought his advice. He listened patiently while I explained the type of output circuit and the symptoms. Then he gave his opinion.

"I'd suggest you give it away," was his advice. "That was a notoriously cranky circuit. It could be made to work, but the lower 6V6 was a sitting duck. If you examine it closely, the circuit looks awfully like a Hartley oscillator. A lot depends on the output transformer."

VERY LOGICAL

I'm afraid it sounded painfully logical when he put it like that, while it also suggested a possible reason for the rough and ready cure. Assuming that the circuit had originally been stable, it seems likely that the output transformer may have been replaced at some later date, due either to its failure, or to accommodate a different speaker.

This probably had the undesirable characteristics (i.e. undesirable in so far as this circuit was concerned) already mentioned, causing the whole thing to take off. And, presumably, whoever made the change could find no cure other than the .1 mfd.

All conjecture, of course, but a reasonable one I think.

The next problem was, what to do about it. Drastic circuit changes were out of the question for obvious reasons, yet it was equally unthinkable that the set should be left in its present form.

From the distant past I strove to recall a somewhat similar circuit which had once been popular. I seemed to remember that the signal for the lower valve was picked off the screen rather than the plate circuit of the upper valve, possibly to remove the very objection which was now so evident.

Once again my colleague came to the rescue. Not only was he able to recall the circuit in detail, but also to confirm that it did, in fact, avoid most of the problems mentioned. So, armed with his instructions, I set to work.

(Continued on Page 111)

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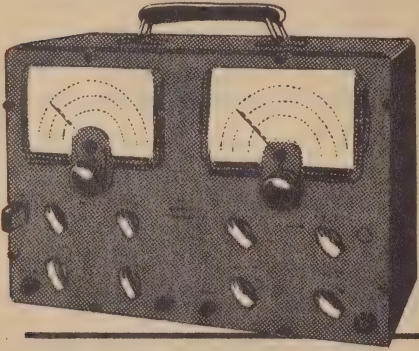

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	B	150 Mc.-270 Mc.	Fundamentals
	Marker A	3 Mc.-11 Mc.	Fundamentals
		9 Mc.-33 Mc.	Harmonics
	B	19 Mc.-75 Mc.	Fundamentals
Marker Calibration	Within 1% or better		
*Quartz Crystal**	(or 5.5 Mc.), ± 0.05%		
Output Voltage	over 100,000 microvolts		
Accessories	Cables: 75 Ω R.F. Output, Ext. Marker In		

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Mod. Frequency	Approximately 400 cps.
A.F. Output	2 to 3 volts
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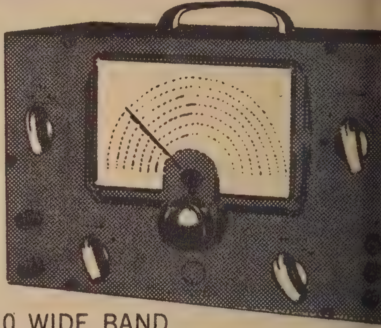
Tube Complement	12BH7, 6AR5
Power Supply	AC, 50/60 cps., 115, or 220 V., as specified; 12 W. approx.
Size and Weight	16 x 25 x 11.5 cm.; 2.7 kg. (6½ x 10 x 4½ in.; 6 lb.)



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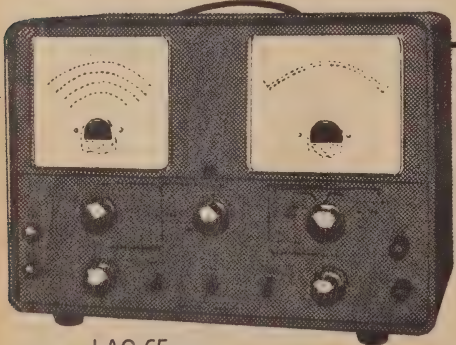

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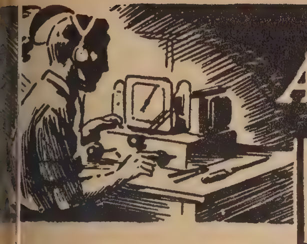
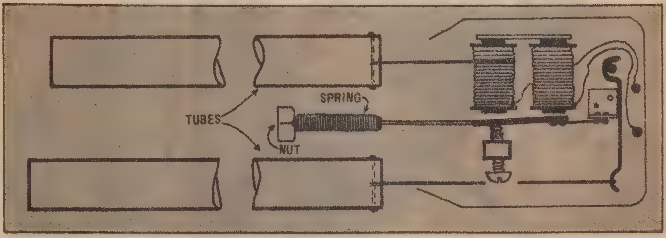


A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

LECTRIC BELL CONVERTED TO DOOR CHIMES

F m Mr A. J. Barnes of 11 Wil- ki son Lane, Telopea, N.S.W. w received this article detailing h he had constructed a set of d r chimes from oddment parts.



SCRIBING the project, Mr Barnes rites as follows:

"A er we had installed the wrought- n screen door we could not, of ur ring the front-door bell. It in take long, however, to screw a l-ess button outside and hook it up a eap electric bell and a cycle lamp te.

"U fortunately the bell proved to be ucous and startling and attempts q eten it made it sound groggy, so ea of making up a simple electric came to mind.

e first problem was to find two ta e tubes for the chimes. As the a vas born on a Saturday afternoon d was a bother to get into town y, we 'scrounged' round to see a we could find.

"I a roadside rubbish dump (and lon't have to look far for these) ound an old bicycle frame from we were able to cut a pair of in all solid drawn steel tubes. If es tubes are to be purchased, it would eferable to use brass, as it can s be polished to a handsome ap- ance and has a nice, mellow tone.

" e tubes we used were cleaned and li ed (paint tends to deaden the tone) d an eighth-inch hole was drilled gh both walls of each tube about a er-inch from one end.

" ext a loose-fitting pin (a long -inch screw in our case) was d through each tube and we were able to suspend them by pieces of fishing line and check for tone by ng with a screwdriver.

" is important that the tubes be nded by the thinnest possible thread loose-fitting pin, so that they can e with little or no damping.

" ne of the tubes was left at its ori- length of about 20 inches, making asing 'low note.' The other tube hortened an inch at a time until it led a pleasing 'high note.' Now ad to devise something electrical to l the tubes and, to do this, sundry itions were performed on the ori- electric bell.

rst, the gong and its supporting vere removed, the hammer arm htened out and the hammer head armature contact spring blade cut The contact adjusting screw was discarded and a longer armature stop screw put in its place.

"A tension spring (closed coils) of about quarter-inch diameter and two-inch length was soldered at one end to one end of the hammer arm. To the other end of the spring we soldered a 5/16in brass nut to serve as a hammer.

"Now the action of this spring is rather cunning because the hammer is clear of both tubes when the armature is against the magnet poles or the stop screw. However, the momentum of rapid action allows the hammer to strike the tubes, because the spring deflects sideways, then quickly straightens up again. There is no jangling, as there would be if a blade spring were used.

"Finally we connected both ends of the magnet winding to the terminals and suspended the tubes adjacent to the hammer. In our case one tube was tied directly to the lower magnet coil and the other to a wire hook as shown in the sketch.

"Alternative methods of mounting are: (1) Make a cross bracket and attach it to the cover holding screw and (2) fit the whole works to a baseboard carrying two long screws from which the tubes could be suspended. In any case it is necessary to adjust the spacing between hammer and tubes so that the hammer gives each one a single sharp tap when the armature hits the magnet poles or the stop screw."

SOUND DIRECTIVITY

(Continued from Page 23)

Also, if a sine wave is turned off or on within a tenth of a second, thereby producing a transient, the direction of the source can be spotted accurately.

This series of tests provides some very interesting and fundamental information about how we determine the direction of sound sources. First, there must be slight head movements to keep the apparent source of the sound "external" to the observer. Second, the inter-aural amplitude and phase of the sounds reaching each ear must correspond to that arising from a real localised sound source, or the observer will be unable to determine its direction accurately.

Investigations of this nature are helping to give a better understanding of how we perceive sound directivity, and thus will help in developing better and more effective sound systems.

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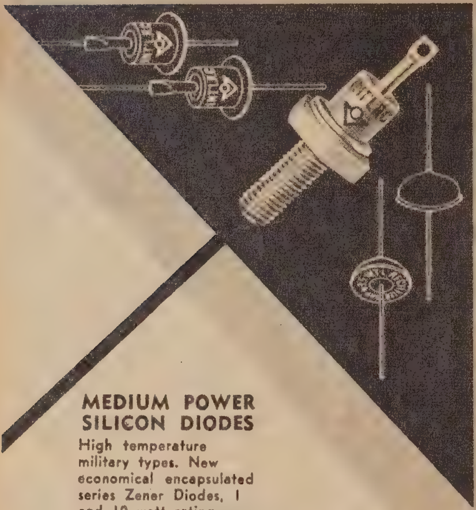

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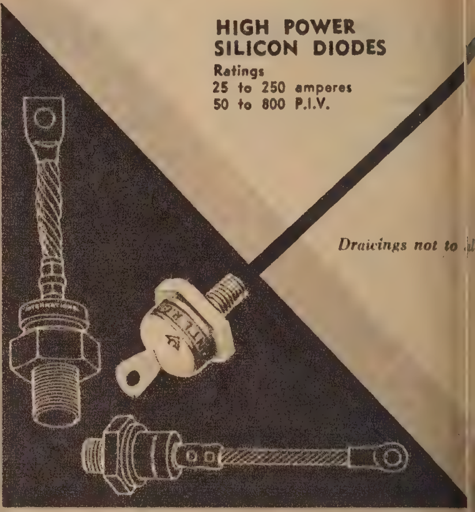

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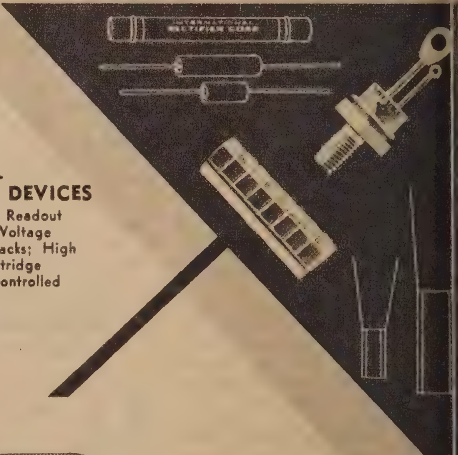

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Here's your answer, Tom!

s we mentioned last month, the topic for discussion in this issue is audio measurements. stortion meters of both the fundamental rejection and individual harmonic percentage easurement types are treated, with a brief look at intermodulation distortion and power output measurements.

By JAMIESON ROWE

VEN audio signals are passed through an amplifier, it is usually case they are required to be increas- amplitude. Thus the tiny signals or a gramophone pickup or tape-re- head are passed through an am- to render them sufficiently power- operate a loudspeaker, for com- le listening.

A amplifier as such, then, is required y to increase the amplitude of a . "What comes out" should be y a bigger or amplified version of goes in." In practice, however. fiers always tend to modify the s fed through them. The cheaper amplifier and its components, the it tends to do so.

hen this occurs, and the output of mplifier is not an exact (though r) replica of the input to the ampli- we say that DISTORTION has oc- d. The output signal is said to distorted version of the input.

nerally, there are two types of dis- n which may occur. One might called "frequency distortion," in h the frequency components present e input to the device are not present e output in the same proportions.

OR FREQUENCY RESPONSE

his occurs mainly if the device has fficient bandpass or frequency re- se to handle all the frequencies h it is desired to pass, or if it has qual amplification or phase shift for frequencies. Testing the device for uency response and transient re- se (perhaps with square waves) usu- indicates the presence of this type listortion.

he other type of distortion is cor- ly called "non-linearity distortion," usually manifests itself in two ef- s, called "HARMONIC DISTOR- N" and "INTERMODULATION TORTION."

The first is said to occur when a single sine wave passed through the device under test appears at the output accompanied by frequency multiples (harmonics) of itself which have been produced within the device. The second harmonic has twice the frequency of the fundamental tone, the third harmonic has three times the frequency, and so on. When distortion occurs, a variety of harmonics is usually present.

ADDITIONAL FREQUENCIES

The second effect is said to occur when two sine waves of differing frequency passed simultaneously through the device emerge from the device accompanied by sum and difference frequencies produced within the device. The input frequencies may be F1 and F2, while the output content is F1, F2 (F1 minus F2) and (F1 plus F2). This is equivalent to one signal amplitude-modulating the other, showing why the name "intermodulation" is used.

A point to keep clear is that harmonic distortion and intermodulation distortion are both produced by the same cause—an amplitude-dependent non-linearity in the device concerned. With signals containing more than one frequency component, BOTH effects are usually produced by such a non-linearity.

Intermodulation distortion can be assessed conveniently by observing on the screen of an oscilloscope. the modulation envelope produce by the two frequencies. Harmonic distortion, however, cannot be observed so readily, at least for small percentages.

Various types of measuring instruments for harmonic distortion measurement have been developed (usually called "distortion meters" or "wave analysers"). Before we consider the operation of some of these instruments, a few words on the definition of harmonic distortion may be in order.

When harmonic distortion takes place, harmonics are present in the output signal which were not present in the input signal. A convenient way of indicating just how much harmonic distortion has taken place is to measure the total amplitude of the introduced harmonics, and express them as a percentage of the complete output signal.

Thus a figure of 5 per cent total harmonic distortion means that of the total output, the fundamental (original signal) forms only 95 per cent, and the other 5 per cent is due to harmonics introduced by distortion.

NOISE AND HUM

This basic statement assumes that the output signal contains only the amplified fundamental and distortion harmonics. If other components, such as noise and hum, are present, due allowance would have to be made for them.

The first type of harmonic distortion meter which we will discuss does, in fact, include these other components in the signal. In many applications this is of no consequence, as hum and noise are often very small components. However, in all cases where an instrument of this type is used, particularly where hum and noise are NOT negligible, it should be noted that hum, noise and harmonics are all lumped together and read as "distortion."

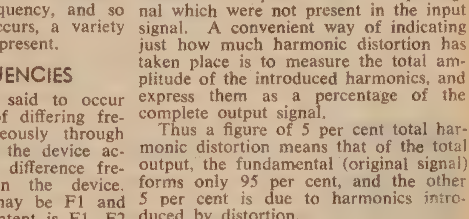
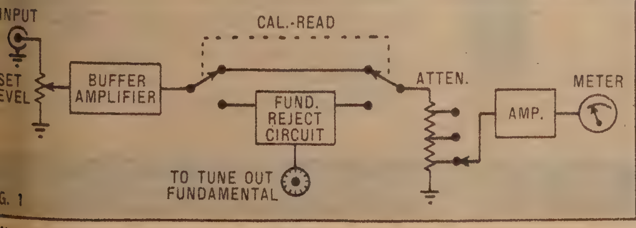


FIG. 2

This type of distortion meter is known as the "fundamental rejection" type and its main feature is that it allows quick, direct reading of the total harmonic distortion present, with the reservation mentioned above, of course.

The block diagram of an instrument of this type is shown in figure 1. The



G. 1

MAGRATHS

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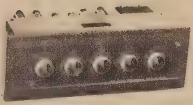

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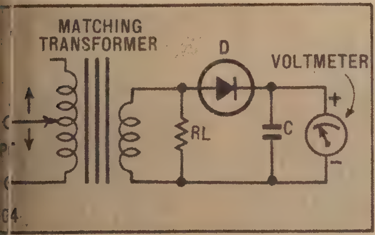
to be examined is first passed a low-distortion buffer amplifier, ıte the circuit under test from ;asuring circuit. This prevents ion between the two and also up the signal to a suitable de.

the signal comes to the heart instrument, the fundamental n circuit. With the switch in the shown (CAL or calibrate), how- he signal by-passes this circuit ısses on to a valve voltmeter comprising a calibrated attenu- 1 amplifier and meter circuit.

is the operating procedure: First nal is fed into the circuit as with the voltmeter attenuator set least sensitive position, marked r cent on most instruments. The evel" volume control is then d so that the meter reads full r 100 per cent. Thus the total represents full reading on the

"CAL-READ" switch is then d, passing the signal through the nental rejection circuit. This may the form of a "Bridge-T" circuit "Parallel-T" circuit, both shown ic form in figure 2. They both a similar fashion, behaving as en circuit at a unique frequency ined by the C, L and R con- of the circuit.

ise, the rejection circuit is tuned fundamental frequency. Thus, s the frequency which is not on—it is rejected, as the term s. All the rest of the signal passes before, to the valve voltmeter .



4

reading which now appears on eter thus corresponds to the total minus the fundamental component, e distortion components if we t hum and noise. If the scale is ld in percentages, this then gives ercentage of harmonic distortion. ttenuator allows the meter sensi- to be increased to enable low gs to be made and may be marked er cent, 30 per cent, 10 per cent, cent . . . etc., indicating in each the percentage registered as full if the total signal was calibrated) per cent.

VIDUAL HARMONICS

ile an instrument of this type s us to read off the total harmonic tion present, there are often ons when it is desirable to know ercentage of each individual har- . How much second harmonic, for ce, or how much third. Informa- f this type is often very helpful in ng down the cause of the distortion. instrument which allows measure- of individual harmonics in this er is the "wave analyser" or rum analyser." The block diagram such an instrument is shown in 3.

As before, the signal passes through a buffer stage and "level set" potentiometer. Then it passes through a modulator or mixer stage where it is mixed with the output of a variable frequency oscillator. This oscillator is tunable over a range which is typically 30 Kc to 50 Kc and its tuning dial is calibrated directly in the difference between its frequency and 50 Kc.

In other words, the dial may be calibrated from 0 to 20 Kc, but, in actual fact, the oscillator tunes from 50 to 30 Kc.

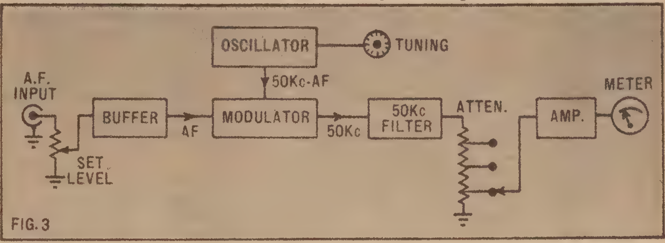


FIG. 3

The output from the modulator stage containing, among other things, the sum frequency of the audio and oscillator signals, is then passed through a filter sharply tuned to 50 Kc. As this is a narrow-band filter, all but signals having a frequency of 50 Kc plus or minus a few cycles are excluded from passing through the filter.

Thus, only audio signals having a frequency equal to the oscillator dial frequency will produce a signal in the modulator capable of passing through the filter and on to the meter circuit. (Example: If the oscillator dial reads 10 Kc, the oscillator is operating on 40 Kc and the only audio signal which will result in a 50 Kc signal to pass through the filter is one of 10 Kc.)

Following the filter, there is the familiar attenuator, amplifier and meter circuit to read the amplitude of the selected signal.

TUNABLE VOLTMETER

Obviously, the whole instrument is a very selective voltmeter using the "superheterodyne" principle and enabling the magnitudes of the fundamental and distortion harmonics to be measured. The procedure is simple: The meter is tuned to the fundamental, with the attenuator set to the 100 per cent position, and the input level set control set to give full scale deflection.

The tuning dial is then tuned to twice the fundamental frequency, and the second harmonic (if any) read off on the meter. The third harmonic may then be read off, and so on.

In addition to percentage scales, the instrument may also be provided with decibel scales, to enable the harmonics to be read off as a logarithmic ratio of the fundamental.

A point to note is that, whereas the wave analyser enables exact information to be obtained on each harmonic, it is a rather cumbersome instrument to use in measuring the total harmonic distortion. Thus the more fallible but direct-reading distortion meter finds considerable use in many applications.

A measurement which is often required in audio work is the power output from an amplifier or similar device. While this may be done by measuring the current and voltage associated with the load of the apparatus, and multiplying the two, a simpler and more common way is to use a direct-reading power output meter.

The basic circuit for a unit of this type is shown in Figure 4. Basically, it consists of a fixed load resistor R1, together with a diode D, capacitor C and voltmeter wired to monitor the voltage developed across the resistor. Since the resistor R1 is constant, we can say from Ohm's Law that the voltage developed across it is proportional to the square root of the power dissipated in it (P equals E squared divided by R, so E equals the square root of P times R).

Since the power dissipated in the resistor R1 is the power output of the unit under test, the scale of the voltmeter may be calibrated directly in terms of power input, in watts or milliwatts. The diode D is used to allow only the positive half-cycles of the alternating voltage across R1 to actuate the DC meter movement, and the capacitor tends to smooth out the meter voltage.

The matching transformer is used to transform the actual load resistor R1 into the correct load resistance required by the device under test. It is simply a regular transformer, having two windings wound on an iron core made from laminations.

The primary, which connects to the

(Continued on Page 65)

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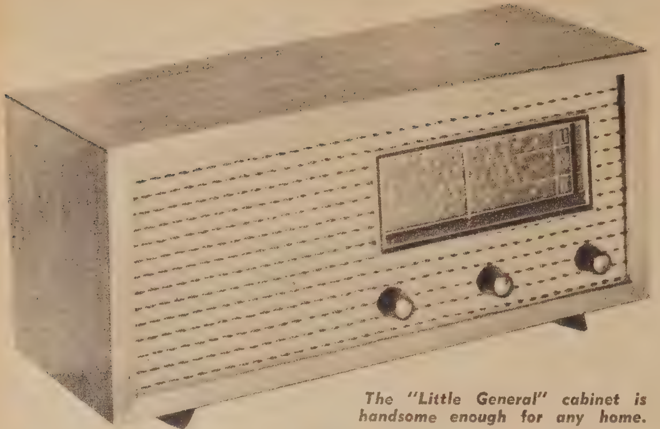


The "Little General" cabinet is handsome enough for any home.

A Cabinet For Your 1961 Little General

Having completed our description of the "1961 Little General" chassis, featured over th last three months, we now present the final step; the construction of a cabinet worthy of th fine little receiver. Even if your woodworking skill is only average, this design will produc a cabinet which can take its pla ce, with pride, in any setting.

By John Davidson

TO make the job as simple as possible, without prejudicing the final result, we have made extensive use of several commercial products. The most important of these is laminated plastic sheet — Laminex, Formica, Panelyte, etc. — which is available in attractive and easily matched wood grain finishes. It provides a convenient way to cover any not-so-neat woodwork in the basic cabinet.

"Tygan" woven plastic speaker fabric, available in a range of colours and designs, is used to cover the front panel. Thirdly, anodised aluminium covered mouldings are used in place of the bakelite escutcheon supplied with the dial, and around the edges of the cabinet.

Coming to the actual constructional details, we commence with the cabinet proper. Almost a page has been devoted to drawings, giving the dimensions of all sections and an isometric view of the assembled pieces.

SIMPLE CARPENTRY

Plywood of ⅜in thickness is used throughout and, because it will all be covered finally, its appearance is of little consequence. It will be noted that the sides, top and bottom are simply butt jointed, requiring very little skill and knowledge of carpentry. Note, however, that the top and bottom are fitted "inside" the ends in order to make a stronger job.

A suitable wood glue is applied to these surfaces and three or four panel pins nailed along each edge serve to hold the assembly together while drying. It will be noted that the front edge of the cabinet is designed to slope forward at the top and the dimensions given for the top and bottom pieces allow for this slope to be planed along the front edge. This is simply a continuation of the slope which exists on the front edge of the side pieces.

The next step is to cut and plane the front panel to suitable dimensions to fit the inside of the cabinet, allowing for the thickness of the covering fabric. The location of the various cutouts can be seen on the front panel diagram.

Both the dial and speaker cutouts were started by drilling a number of small holes along the waste side of the cutout lines and finishing the job off with a coping saw. Holes for the three control spindles were made with a ⅜in drill.

While the cabinet is drying we can proceed with the covering of the panel. To prevent the speaker cutout being visible through the relatively coarse weave of the speaker fabric, it is recommended that this panel should first be coated with a flat black paint.

When time has been allowed for this to dry, apply an even coat of P.V.A. glue over the full surface of the panel and then place the fabric in position. It should be cut to allow a border of about ¾in. Care must be taken to align it correctly, keeping the direction weave parallel with the sides panel. (P.V.A. glue is a white em which is colourless when dry.)

Then fold the fabric around the edges, neatly cutting away the formed at the corners, and staple along the back of the panel. It ca be placed face down on a flat, surface and allowed to dry under sure.

The next step, when this has dr to cut the fabric to clear the dial and the holes for the control sp Providing that the P.V.A. glue has well applied it should be quite in to cut this off neat with the edge cutout.

DIAL CUTOUT

Next step is to fit the profile a the dial cutout. As mentioned e we have used anodised aluminium ed wood moulding, profile 1002 "Schock" brand being selected. T the same as that used on the c of the "Transistor Eight."

We recommend that the mouldi first cut to slightly oversize lengths mitred and filed down at both ends final length. Some difficulty ma experienced in cutting these mould by either filing, or cutting on the stroke of a fine saw blade, it s be overcome without too much

The mould should be finished by checking both the equal length opposite sides and the matching of adjacent sides. When this is factory, the moulding can be fitt place around the dial cutout using a any glue which happens to be handy

Returning to the cabinet p having allowed some time for the to dry, the next step is to plan front edges of both the top and b in line with the slope of the side p Then, with the plane blade finely clean up the end grain at the corners, remembering to work from ends towards the centre to avoi risk of chipping the edges.

PLASTIC BOARD

The stage has now been reach which we are ready to fit the lami plastic board. We were able to pi off-cut of dark wood-grained Lam just large enough to allow a side, and side piece to be cut off in that enabling the grain to be matched a two top corners.

Cut sections to fit the top and of the cabinet, allowing for some lap, especially on the top section. S contact cement on the surface of side of the cabinet and the correspo piece of board with a suitable appli and allow to dry for approximatel minutes.

Carefully align the back edge o cabinet with the corresponding edg the board without making contact when it is level, lower first the and then the rest of the board on to the surface of the cabinet. In diately apply pressure, working from owards the edges to avoid trap- · bubbles.

xcess board can now be trimmed he four sides with a finely set nd the same procedure repeated other side of the cabinet. Finally, section can be cemented in posi- lowing it to lap over the ends side pieces.

this is trimmed along all four t only remains to finish off the dge of our cabinet. The profile for this purpose was "Schock" 39, the rounded edge being on de, it was also cut, mitred, filed, ed in similar manner to the dial profile, except that after glueing, inet was laid face down on a face and allowed to dry under the weight of a couple of heavy test instruments.

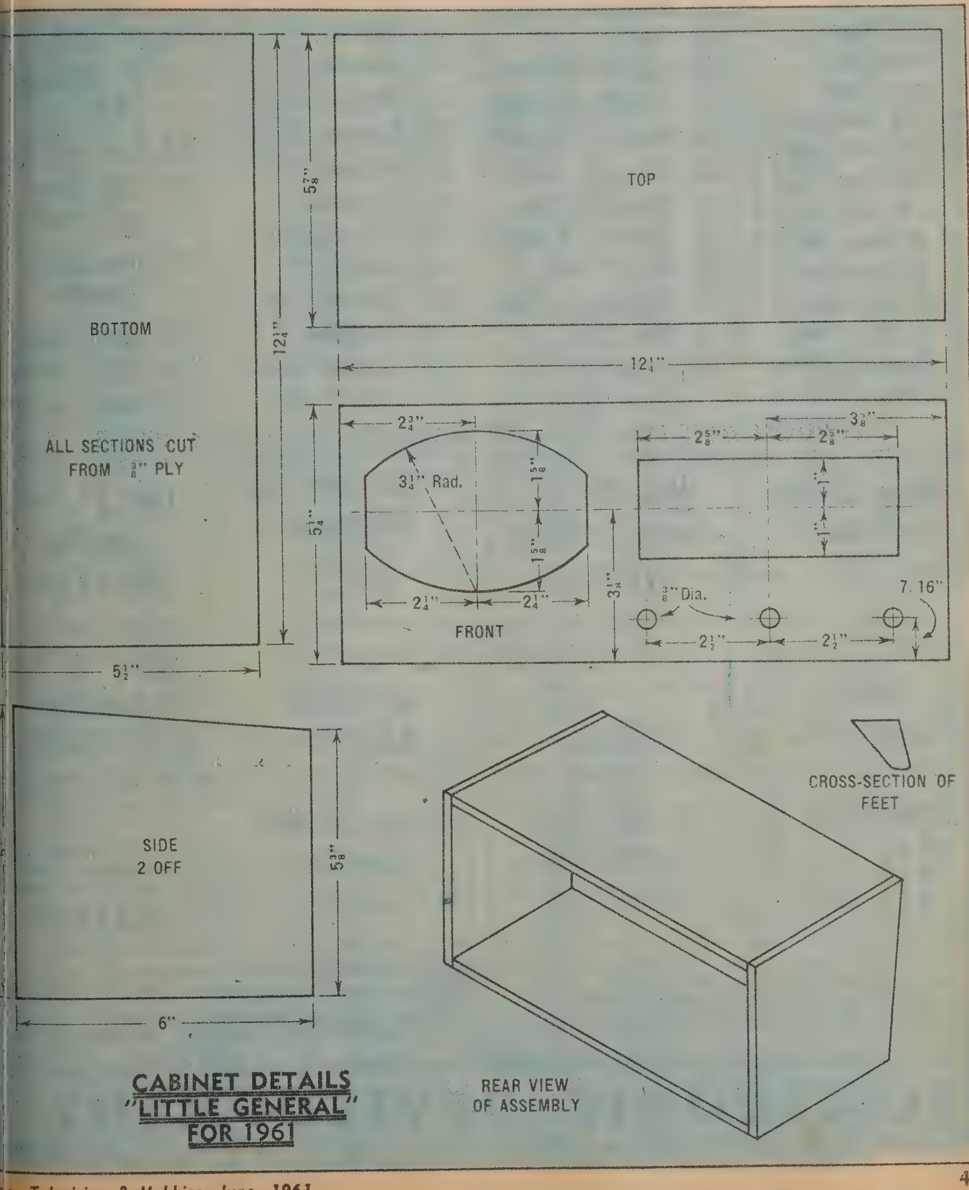
The 5 x 4 inch oval loudspeaker can now be mounted and the front panel fitted into position in the cabinet. The cross section view of the feet is shown in the drawing and two strips 5 inches long are required. These are tacked along the bottom with panel pins, raising the height of the cabinet by about ¾ of an inch.

Finally, the bottom of the cabinet, the feet and the exposed section of the inside face of the cabinet immediately in front of the panel should be brushed over with a dark wood stain similar to the shade of the laminated board.

Although we have specified a Laminex-type finish, there is no reason why the basic design cannot be used for a leatherette-covered cabinet. Space does not permit detailed explanation of this technique, but a good-quality lightweight material should be chosen, preferably in the modern plastic finish.

A variety of glues may be used, including hide, casein, and P.V.A. A reasonably fast-drying glue is desirable, but the contact adhesives are likely to be too drastic. However, they may be useful for "tacking" the edges while the main glue sets.

The set can be held rigidly in the cabinet by means of a couple of small brackets bolted to the rear edge of the chassis and screwed to the inside of the cabinet. Walnut coloured, gold centred knobs add the final touch to the set.



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Dual Type 1007
4-speed Player

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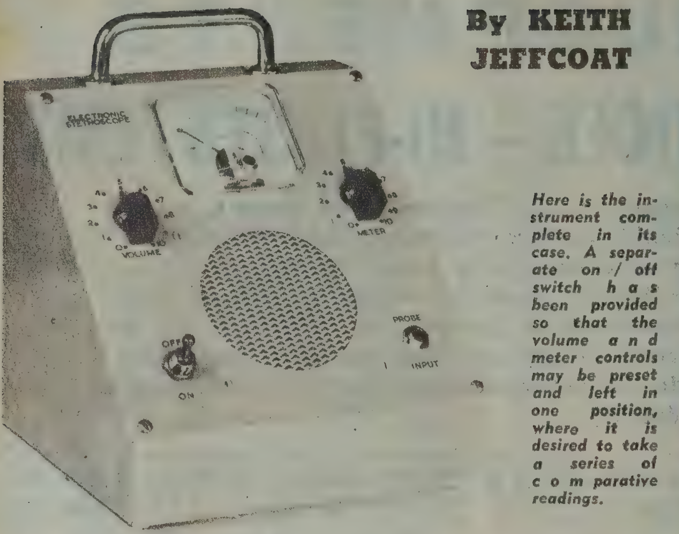


By KEITH JEFFCOAT

Here is the instrument complete in its case. A separate on / off switch has been provided so that the volume and meter controls may be preset and left in one position, where it is desired to take a series of comparative readings.

Track Down Noise. With This

NEW ELECTRONIC STETHOSCOPE

Here is a transistorized electronic stethoscope especially designed for listening to aut- mobile engine and transmission noises. The instrument is competely self-contained and h two separate microphones, one for listening to noises around the motor and the other listening to transmission noises while the vehicle is in motion.

THE instrument has been tried and tested by a number of skilled mechanics and engineers, including the technical engineers of the N.R.M.A. In all cases it was most enthusiastically received.

The need for a unit such as this became evident when one of our staff members had occasion to take his car to a mechanic for diagnosis of an obscure fault in the transmission system. The fault-finding procedure went somewhat as follows:

First the mechanic took the car for a drive through some quiet back streets and attempted, by careful listening inside the car, to localise the source of the trouble. When this failed to work, he passed the wheel over to our staff member and conducted a further listening test laying prone on the floor with his head hanging out of a half-opened door.

Once again he was unable to pinpoint the trouble, mainly due to the fact that this make of car comes complete with a slight noise in the differential as "standard equipment," and it was impossible to separate this noise from the one which had recently become apparent. At this stage it was decided to drive the car back to the garage and install it on the hoist where it would be possible to place an acoustic type stethoscope against the suspected parts with the motor running and the car in gear.

Even this procedure was not entirely satisfactory, because it is almost impossible to duplicate road conditions under these circumstances. Eventually, however, the mechanic was able to state with some finality that the noise was definitely coming from the gearbox and, as a reasonable price was quoted for repair of the offending object, the necessary work was undertaken.

DISCUSSION

Against this background, our staff began arguing about the problems of noise location in general and automobile noises in particular. The present instrument is the result of these arguments and discussions!

Most mechanics possess some form of listening device, whether it be a proper acoustical stethoscope or only an extra-long-bladed screwdriver, used in lieu of the former. Both of these devices have rather obvious limitations: (1) They will not amplify—in fact they do just the opposite, and (2) they w extremely impractical, in fact ra dangerous, to use for testing a ar or differential while the vehicl is motion.

It would appear then that the to both of these problems is i form of amplifier and suitable phone which could be attached transmission system, enabling th anic to listen to noises under th conditions in which they occur same unit could be used to rem strain of finding those obscure which develop under the bonn time to time.

Before tackling the problem sort of amplifier to use, it is n to establish what sort of microp are going to employ. It was thought that one of the crystal contact microphones would be s but an examination of the co under which it would be expe work soon dispelled this idea.

MICROPHONE

During the course of normal performed on a motor vehic microphone would be subjected t mechanical vibrations, in addit possible large variations in temp From previous experience we kn crystal units do not take kindly t conditions and our thoughts acc turned to the more robust types ing coil units.

During World War II, a receive mitter combination known as th less set No. 19 was developed es for use in tanks and armoured ca unit used an extremely robust moving coil microphone which impedance of 45 ohms and was he ally sealed in a solid metal case, heavy protective grille over th phragm. Since large numbers o units are still available from sources, it was decided to constr instrument around this microphon

Two of the units are used in being modified for attachment transmission system and the other a 6-inch metal probe soldered metal grille for use around the This probe is necessary in ord sound may be picked up from which are inaccessible by hand, e water pump bearings.

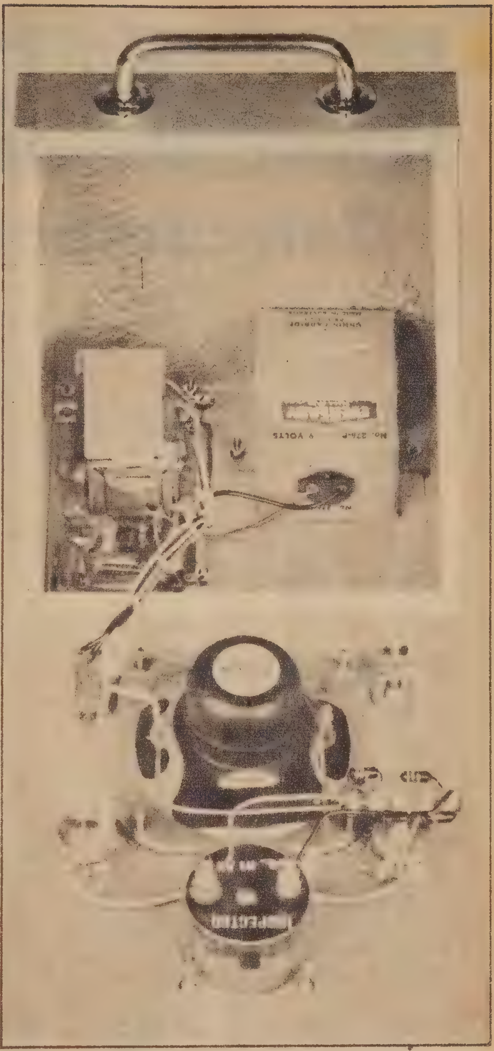
The amplifier used is a standar transistor unit which is availabl a printed circuit board. It was f in the transistor stereo player pu in the December, 1960, issue. Th significant modification made to ginal circuit is the addition of a rectifier and level meter fitted output end.

The purpose of this meter is able comparison tests to be ma tween the noise levels of a motor is known to be normal and one in some part is suspected to be fau

Coming now to the main circu gram, we can see that the micr is fed through a 10K potentiomet a 50mfd isolating capacitor to th e first 2N408 transistor. As in ous designs, this stage uses DC ve feedback to temperature stabi- e operating point. This is achieved nnecting the base bias resistor to ollector rather than directly to the ve supply. Any increase in col- current is offset by reduced bias e base.

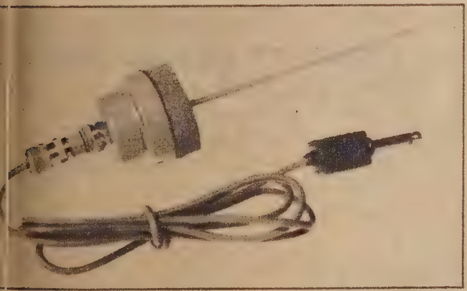
second stage is a driver, using a 8 again. This stage, since it ope- at a higher signal level than the has a more elaborate bias stabilis- rangement. The base bias is sup- from a resistive voltage divider. n emitter swamping resistor (470 plus 10 ohms) is included to p out temperature variations in ase-emitter junction resistance.

output of the driver is fed by a e-ended to push-pull driver trans- ner into the bases of the two 2N217S ut transistors. These two transistors run in class B to achieve maximum ency.



This view shows the internal construction of the instrument. The 4 transistor amplifier is bolted to the bottom of the case with four stand - off insulators to prevent accidental contact between the printed circuit and the case. Note the brass plate, which serves as a heat sink, soldered between the transformers.

is is the straight type microphone used for analys- noises in the transmission system. The sponge ber around the front ensures a close fit to the unit der test and prevents any possibility of mechanical ises caused by the microphone rattling against the unit, whilst the car is in motion.



ere is the probe type microphone used for listening to noises in the engine d its associated components. The probe is constructed of ⅛in brass elding rod and is soldered directly to the protective grille on the front of the microphone.

ERMISTOR

nce the output transistors are ope- g at a high power level, they may rather warm. Temperature varia- in the various parameters are thus ively high and to provide adequate stabilisation over a wide range in erature, non-linear compensation niques must be used.

hus we find that the base voltage der has a temperature-sensitive resis- e element as part of its lower com- ent. The variation in the value of unit (also known as a "thermistor") with temperature matches fairly well the variation in Icbo of the transistor, thus keeping the bias variation within quite narrow limits.

As before, there is an emitter swamping resistor. It is small in value (2.7 ohms), since the emitter of both transistors flows through it, making it seem twice the value as far as each unit is concerned. It can be small for another reason—the emitter base forward resistance of a power transistor is quite low.

As you may have noticed, negative feedback is used from the output transformer secondary to the emitter circuit of the driver stage. This improves the frequency response of the amplifier and lowers the distortion. With feedback, as shown, the frequency response is from 70 cycles to 10,000 cycles between the 3dB points.

The circuitry shown in dotted lines around the level meter is a battery condition tester. Time prevented us from including this in the finished unit, but the circuit shown has been tested and proved to work in a most satisfactory manner. It is suggested that a "push-on" type three pole switch could be mounted in the top right-hand corner of the front panel immediately above the meter control for this circuit.

BATTERY TEST

This circuit places the Level Meter in series with a 20K resistor across the battery so that the meter will read 10 volts full scale and indicate the battery condition. At the same time, a 360-ohm load resistor is placed across the battery. This resistor will draw about 25 milliamps and simulates the normal working condition of the battery. The battery should be replaced when the voltage drops below 7 volts.

The bridge rectifier used to indicate

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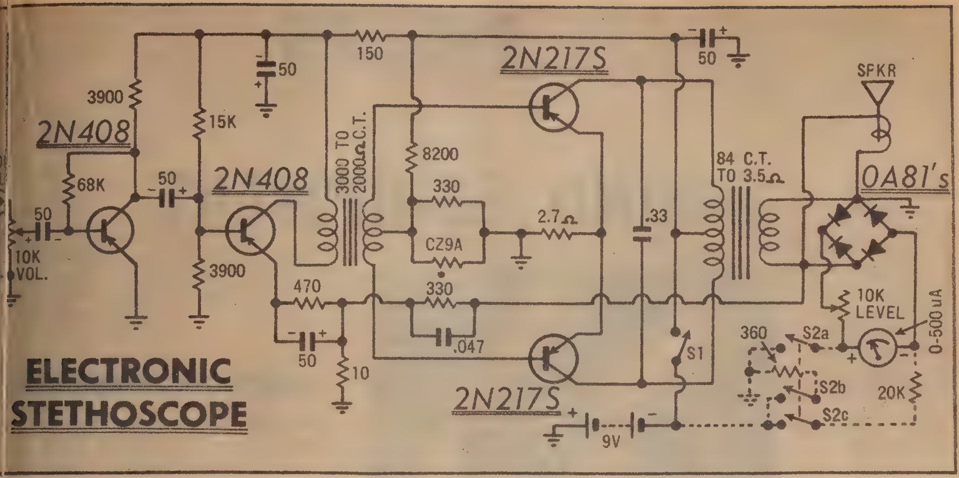


3900
2N408
68K
50
10K VOL.
50
2N408
15K
3900
50
470
50
10
150
3000 TO 2000Ω C.T.
8200
330
CZ9A
330
.047
2.7Ω
2N217S
2N217S
.33
50
84 C.T. TO 3.5Ω
SPKR
0A81's
10K LEVEL
0-500 uA
360
S2a
S2b
S2c
S1
20K
9V

Tl; is the main circuit diagram of the unit. It is basically the same as the circuit of the transistor stereo player ofDecember 1960, the main additions being a bridge rectifier and level meter on the output circuit, and an optional battery test switch.

p' level remains in circuit through- e battery condition test but, due tl high resistance of the diodes in ection to which voltage is applied tm, it will have no effect on the dg.

Tl meter shown in the photographs dr unit is a standard level meter l, as such, has a linear scale cali- t from 0-10 with the divisions from 0marked in red. When used for s level comparisons this meter, if dn its original form, could create a sl ding impression.

EER SCALE

T overcome this difficulty, it is anti- ad that a meter with a reverse log- cale calibrated in noise units and iz a battery test position will be c available especially for this instru- r.

T; unit is constructed in a standard ment case measuring 7½in wide by r deep. The front panel measures rwide by 8in high. A chrome handle fed to facilitate carrying and the tn of the case is covered with a of ½in-thick foam plastic to pre- the instrument scratching any sur- n which it may be placed.

e amplifier is, as mentioned earlier, ucted on a standard printed circuit which was made use of in the isporta Six" and "Transporta ," as well as the Transistor Stereo r. A photograph of this board ng the position of the various com- nts is included to facilitate con- ion.

NTED CIRCUIT

e boards, as available at present, narked with component values suit- to the "Transporta Six" and n." When wiring the unit, it will cessary to check carefully with the am which we have included to sure that the right values of com- nts are placed in their correct posi- These will not necessarily be the value as marked on the board, as

PARTS LIST

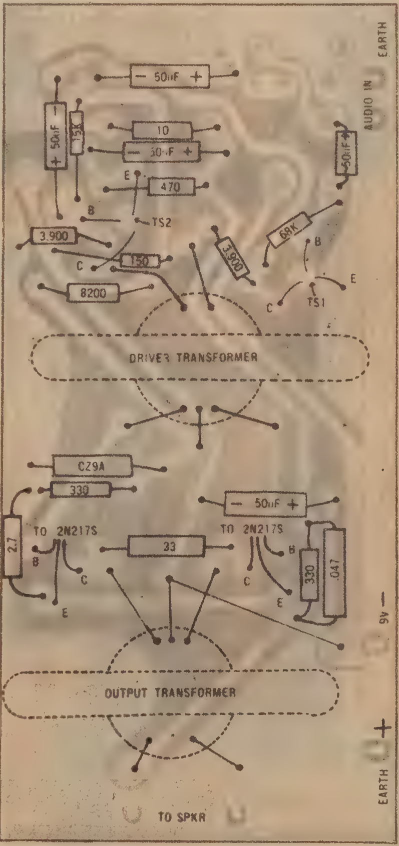
1	Driver transformer — 3,000 ohm primary to 2,000 C.T. secondary.
1	Output transformer — 84 ohm C.T. primary to 3.5 ohm secondary.
1	Thermistor CZ9A.
2	2N408 transistors.
2	2N217S transistors.
4	OA81 germanium diodes.
1	Suitable printed circuit board.
1	9-volt battery.
1	Battery plug — 2 pin.
1	Single-pole single-throw toggle switch.
2	10K potentiometers.
2	Pointer knobs.
1	Telephone type socket.
2	Telephone type plugs.
12	Feet of shielded cable.

CAPACITORS

1	.047 Mfd Ceramic.
1	.33 Mfd Plastic.
5	50 Mfd 12 volt electrolytics.

RESISTORS

1	2.7 ohm 1 watt
1	10 ohm ½ watt.
1	150 ohm 1 watt.
2	330 ohm ½ watt.
1	470 ohm ½ watt.
2	3,900 ohm ½ watt.
1	8,200 ohm ½ watt.
1	15K ½ watt.
1	68K ½ watt.
1	4in loudspeaker.
1	Suitable level meter.
2	Microphone inserts.
2	Co-ax sockets.
2	Co-ax plugs.
1	Suitable instrument case and panel, 6in length of ⅛in diameter brass rod, 20 gauge brass sheet, 5 lug tagstrip, 6½in square of foam plastic, ⅛in brass countersunk nuts and bolts, chrome handle, hookup wire, solder, etc.



EARTH
AUDIO IN
50uF
50uF
15K
10
50uF
470
E
TS2
B
3,900
C
150
3,900
68K
B
8200
E
C
TS1
50uF
DRIVER TRANSFORMER
CZ9A
330
2.7
TO 2N217S
B
C
E
33
50uF
TO 2N217S
B
C
E
330
.047
9V —
OUTPUT TRANSFORMER
+
EARTH
TO SPKR

This is a pattern of the printed circuit board with the position of the various components superimposed on it. The 2N217S transistors not shown in the diagram are mounted on a brass heat sink placed between the driver and output transformers.

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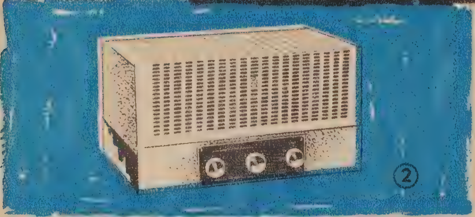

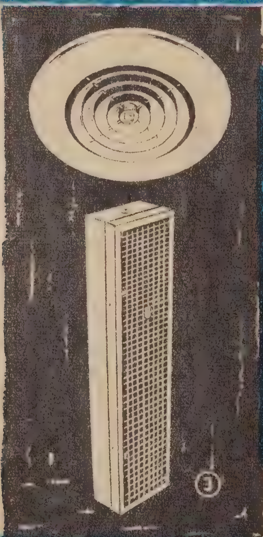

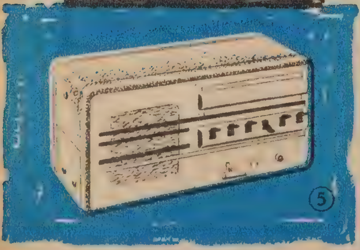

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e designed for different output ors and higher power.

ll be noticed that the position of 2N217S output transistors are own in the printed circuit board n. These transistors are mounted piece of 3in by 1⅜in brass, sol- between the driver and output mers. The position of this can n from the interior photograph.

brass plate acts as a heat sink two output transistors and en- hat they do not exceed their maxi- eat dissipation ratings. The trans- re attached to the sink by means s of shim brass wrapped around nd secured with a single nut and the centre of the strip.

amplifier is secured to the bottom case by means of four ⅛in coun- bolts, with ⅜in-long plastic placed between the board and se to prevent the printed circuit ccidentally coming in contact with e.

NTING

suggested that a nut should be over these bolts and firmly se- before placing the spacers in posi- . This will facilitate removal of plifier for possible servicing at a late. Remember that it will not ssible to place a screwdriver on ad of these bolts once the foam has been glued on the bottom of se.

battery is secured in position by of an aluminium bracket and nuts olts mounted in the same manner amplifier.

mounting and wiring of the com- s on the front panel can be easily rom the photograph showing the r of the instrument. The on/off switch and volume control are at ft of the panel while the probe socket and meter sensitivity control the right.

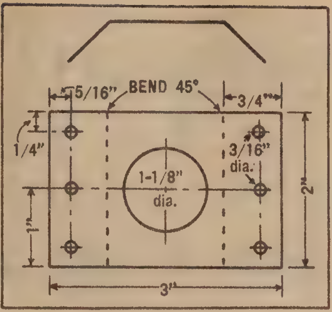
bridge rectifier with its four ger- m diodes is wired on a five-lug p, which is soldered to the cover meter sensitivity control.

h this meter control and the e control have numbered scales front panel, so that it is possible urn them to the same position for rpose of comparison tests between nt motors of the same brand. The ate on/off toggle switch was in- in lieu of the usual switch pot gement so that the instrument be switched off between tests with controls left in preset positions.

NSMISSION TESTS

order that the microphone used for nission tests could be easily ed to the part under suspicion, a y 2in brass plate having three holes her end is soldered to the rear of icrophone. Details of this bracket given in a plan drawing and no lty should be experienced in its ruction.

use, a spring of suitable length is d through one of the holes in one of this bracket, placed around the under test, and secured to a hole other end of the bracket. The pur- of the three holes is so that two or springs may be used if necessary. order that there should be no mechanical vibration between the microphone and the unit under test, a ring of one-inch-thick sponge rubber has been glued to the front of the unit.



This plan drawing will assist in the construction of the brass plate to be mounted on the rear of the unmodified microphone. The three holes in each end allow the unit to be mounted by means of one, two or three springs, whichever is felt desirable.

Electrical connection to the unit is made by means of a co-ax socket soldered directly to the rear of the case. This gives a solid type of connection and enables the microphone cord to be easily repaired in the event of a fracture.

The probe type microphone has a 6in length of brass welding rod soldered directly to the protective grille on the front of the case. To prevent acoustic feedback a piece of thin plastic is glued over the grille and a piece of ½in foam plastic glued on top of this again. This combination also helps to deaden any natural resonances which may be present in the probe itself and which, if left unchecked, may tend to colour the sound from the probe.

Once again, electrical connection is by means of a co-ax type connector soldered to the rear of the unit.

The cord on the probe type unit needs to be about four feet long, while that on the straight type needs to be about eight feet long in order that it should reach from the transmission into the front seat of the car.

CARE NEEDED

When using the level meter for purposes of comparison it is essential that the instrument be maintained at a temperature below 105 deg. F. If the unit were allowed to stand in the sun between readings the gain of the amplifier would be affected and meter readings would become unreliable.

As mentioned at the beginning, the instrument was made available to a number of skilled mechanics and engineers who are activily engaged in the motor industry. All were delighted with the instrument's performance and, in fact, had our policy permitted it, we could have sold the unit many times over. This particular unit, however, is earmarked for our own company garage and we would have an irate manager on our hands if we had allowed the unit to pass from our grasp!

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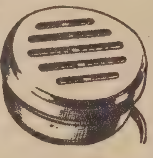

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NEW POWER TRANSFORMERS

60mA prim: 240v with 230v tapping Sec 285 x 285 with 6.3v filament winding 60mA.

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Standard Mica Condensers, small current types .00003 and .005, including most wanted values.

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NEW CRYSTAL MICROPHONES 50/-

NEW POTENTIOMETERS

with SWITCH STANDARD SPINDLE	WITH SWITCH SHORT SPINDLE	LESS SWITCH STANDARD SPINDLE	LESS SWITCH SHORT SPINDLE	TAB. POTS.
25,000 ohms 100,000 ohms 5/6 ea. 50/ doz.	100,000 ohms. 500,000 ohms. 2/6 ea. 24/ doz.	100,000 ohms. 500,000 ohms. 500 ohms. 5,000 ohms. 3/6 ea. 33/- doz.	50,000 ohms. 100,000 ohms. 2 meg. 1/9 ea. 16/ doz.	25 k. 250 k. 1 meg. 2 meg. 2/- each.

25,000 ohm screwdriver adjustment, 1/9.

NATIONAL RADIO SUPPLIES

2 PARRAMATTA ROAD, STANMORE, N.S.W. Phone LM7398

By Jamieso
Rowe

Here is a view of
completed prototy
showing the neat a
functional design of
case and dial. Althou
it is finished in bla
and maroon hammerto
enamel, we understa
the manufacturers w
make a variety of col
schemes available.

An All-Transistor Car Radio Receiver

This single-unit, fully transistorised car receiver offers the advantages of compactness and low battery consumption. The design is most versatile, and may be used in cars having either 12-volt or 6-volt supplies, whether positive or negative earthing. The construction is simplified by the use of a printed wiring board.

EVER since the advent of the "Transporta" series of transistorised portable receivers, we have been considering the idea of a fully transistorised car radio. Indeed, at one stage, we went as far as modifying a standard "Transporta Seven" portable for car operation, and carried out a number of tests upon it.

We weren't too happy with the results, however, and the project was shelved for the time being.

As a result, the next car receiver which we described utilised the "hybrid" principle, with transistors in the audio section and low-voltage valves for the front end. This set, called the "1959 Karset," proved very satisfactory in service. The use of transistors in the audio end reduced battery consumption, while the hybrid valves in the front end enabled high performance to be retained.

Recently, however, the position regarding transistorised front ends has improved considerably, particularly with respect to the transistorised RF amplifier stage.

Just a few weeks ago, the Transistor Applications Laboratory of Standard Telephones and Cables Pty. Ltd. published a circuit for a seven transistor car receiver, which incorporated a suitable RF stage, self-oscillating mixer, and two IF amplifier stages. The circuit had a three-stage audio section fitted with a single class-A output stage, and was designed to operate from either six or 12 volts.

The publication of a circuit by no means solved all the problems associated with the construction of a complete receiver, however, and much work remained to be done before the circuit became suitable for description in this magazine as a practical construction project.

DEVELOPMENTS

A local manufacturing firm, R.C.S. Radio Pty. Ltd., also decided, meanwhile, that the circuit should prove attractive for the homebuilder, and undertook the development of certain essential components and hardware. Finally, as a result of certain co-operation between the above firm, the transistor manufacturer mentioned, and ourselves, the design shown on these pages evolved.

The Applications Laboratory of Standard Telephones and Cables at all stages of the development was most helpful in ensuring maximum suitability of the circuit to the transistors, while we ourselves were able to offer help regarding the most satisfactory and suitable construction for the homebuilder. As you may recall, we carried out extensive investigations into this matter during development of the hybrid
Karset.

To enable readers to construct
final project easily, R.C.S. Radio
Jabel Mfg. Co. have arranged fo
special printed wiring board to b
leased through the normal supplie
addition to the special output
former, components and metal
used. Even by the time this a
appears in print, however, it is
that equivalent components will be
able from other sources.

In order to allow readers to use
circuit boards, or to make boards
their own, we are presenting a dia
showing full details of the board.
diagram should also clear up any
regarding assembly of component
the board, but more of that later.

Before we progress any furth
look at the circuit would seem t
in order. From the aerial, the si
pass through an RF amplifier
utilising a 2N1107 grown-diffused
tion transistor. They then pass
self-oscillating mixer (converter)
designed around a 2N1108 transist

OPERATION

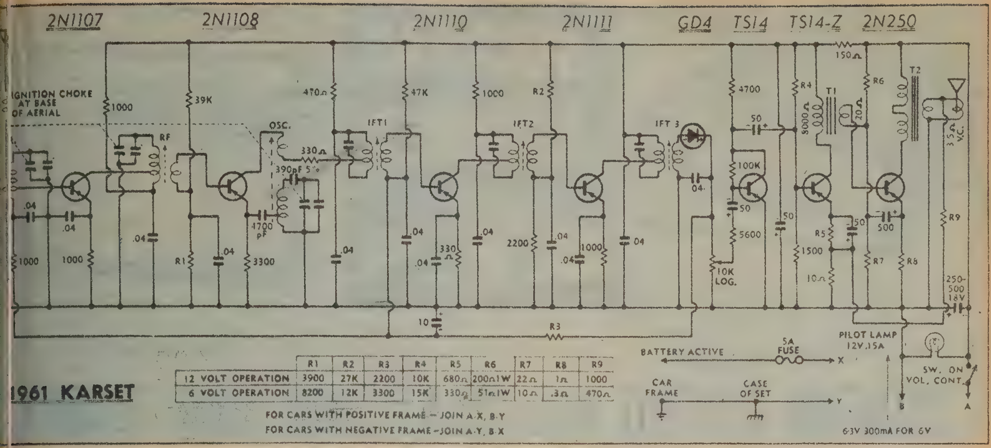
The IF signals produced by the
pass through two stages of IF amp
tion, which use type 2N1110
2N1111 transistors respectively. A
diode is then used to detect the si
and the resulting audio fed via
volume control potentiometer to
audio section comprising a
a TS14-Z and a 2N250 power
sistor.

A positive DC potential deve
across the volume control is fed ba
the base circuits of the RF and
IF stages to provide automatic vo
control (AVC) of the front end.

The receiver is constructed with
entire circuit floating with respect t
case, which means that the polari
the car supply is completely uncri
The circuit may be adapted to suit
polarity merely by reversing the
from the circuit board to the case
supply.

> **This does not mean that the**
> **may be applied to any car with**
> **modification. But it does me**
> **that the set is capable of operati**
> **with any polarity once the requi**
> **connections are made.**

You will notice that the polarit
the circuit supply connections is indi
by the letters A and B (A is the neg
connection. B is the positive one).


2N1107
2N1108
2N1110
2N1111
GD4
TS14
TS14-Z
2N250
IGNITION CHOKE AT BASE OF AERIAL
1000
39K
470Ω
47K
1000
R2
4700
R4
T1
R6
T2
150Ω
RF
OSC.
IFT1
IFT2
IFT 3
330Ω
390pF
50
5000Ω
20Ω
3.5Ω V.C.
100K
04
.04
1000
.04
R1
.04
4700 pF
3300
.04
.04
.04
330Ω
.04
2200
.04
.04
1000
04
50
5600
10K LOG.
50
R5
1500
10Ω
50
500
R7
R8
R9
250-500 18V
10
R3
BATTERY ACTIVE
5A FUSE
X
PILOT LAMP 12V.15A
SW. ON VOL. CONT.
CAR FRAME
CASE OF SET
Y
B
A
6·3V 300mA FOR 6V
1961 KARSET

	R1	R2	R3	R4	R5	R6	R7	R8	R9
12 VOLT OPERATION	3900	27K	2200	10K	680Ω	200Ω 1W	22Ω	1Ω	1000
6 VOLT OPERATION	8200	12K	3300	15K	330Ω	51Ω 1W	10Ω	.3Ω	470Ω

FOR CARS WITH POSITIVE FRAME — JOIN A-X, B-Y
FOR CARS WITH NEGATIVE FRAME — JOIN A-Y, B-X

lere is the circuit of the receiver, showing the modifications to the basic design for various polarities of supply roltage. The changes required to component values for the two supply voltages are also given, but readers should iote that for 6 volt operation, the output transformer should be rewired as per the small circuit at the bottom of the page.

ls coming from the battery, which are nnected to the case, are marked X a Y, the latter being the connection t to the car frame and the case of t set.

he connection between the pair A a B and the pair X and Y will depend u n the polarity of the car supply. If t car supply has the positive terminal o the battery connected to the frame, o iously A and X should be joined, and a B and Y.

ONVERSE

f, on the other hand, the car has a n ative earth system, the connections s uld be reversed, with A joining to Y a B to X.

ery obviously, for all this to be valid, p per insulation must be maintained b ween the "earthy" circuits and com- p ents on the board, and the outside m al case.

o adapt the set for differing supply v tages, rather more complex changes m st be made to the circuit. Alteration o bias supply components for many of t transistors is necessary, particularly i the case of those operating at signifi- c t power levels, such as the audio o put stage.

The various components which must be changed in value are shown in the circuit, together with the alternative values for 6 and 12 volt operation. The alternative connections for the output transformer are shown in the auxiliary circuit diagram.

For large changes in supply voltage, it also becomes desirable to alter the effective load of the output transistor to maintain efficiency. Thus you will notice that the primary of the output transformer is in two sections. For operation in 12-volt cars, the two sections are wired in series, giving the transistor an effective load of 20 ohms. For 6-volt operation, the two are wired in parallel, which reflects a load of only 5 ohms. In this manner the transistor is able to deliver the full output at the lower voltage.

You will notice that the audio section incorporates voice coil-to-emitter negative feedback. This is intended to reduce the distortion of the driver and output stages, as well as stabilising the gain. Things are not just as simple as they might appear concerning the feedback, however, and a brief explanation of the factors involved would seem to be in order.

In the parallel case with power amplifiers using thermionic valves, there is usually a limit to the amount of negative feedback which can be applied to the loop containing driver valve, output valves and output transformer. This is mainly a factor of transformer characteristics (phase shift, etc.) and coupling network time-constants.

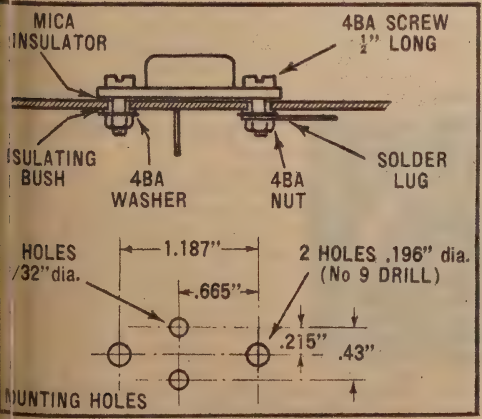
The maximum value commonly considered to be "safe," and the value which we ourselves have consistently recommended and used in projects, is about 20 dB. This takes into account the variation in transformer and component values likely to be encountered.

Because of the relatively small "spread" or range in gain values for valves, this figure may usually be approached quite closely.

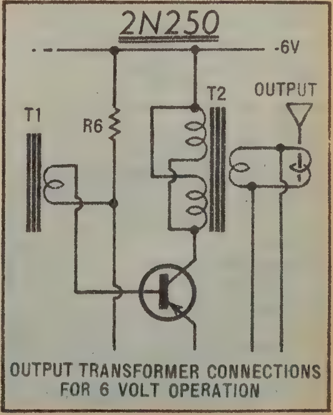
MORE COMPLICATED

In the case of transistor power amplifiers, however, the matter becomes more complicated. This is because transistors generally have a relatively large characteristic spread. For a certain specified output transistor, for instance, individual samples may vary in gain from about 40 to around 300.

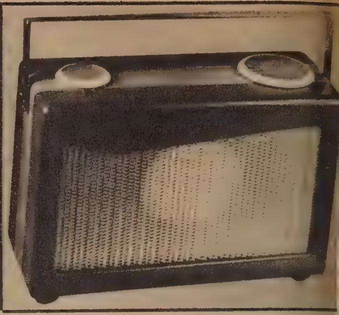
Obviously this wide range in gain is


MICA INSULATOR
4BA SCREW ½" LONG
ISULATING BUSH
4BA WASHER
4BA NUT
SOLDER LUG
HOLES /32"dia.
1.187"
.665"
2 HOLES .196" dia. (No 9 DRILL)
.215"
.43"
OUNTING HOLES

Here are details of the power transistor mounting (left) and output transformer wiring for 6 volt operation (right). Note the use of a thin mica washer between the output transistor and case to provide electrical insulation yet heat transfer away from the transistor.


2N250
-6V
T2
OUTPUT
T1
R6
OUTPUT TRANSFORMER CONNECTIONS FOR 6 VOLT OPERATION

SUCCESS ASSURED WITH R.C.S.



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- RF Coil, Part No. 252.
- OSC Coil, Part No. 248.
- 1st IF Part No. 145.
- 2nd IF Part No. 146.
- 3rd IF Part No. 147.
- Slide Rule Dial Part No. 459.
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- Co-ax Plug and Socket.
- Mounting Brackets.
- Grommets.
- Fibre Washers.
- Earth Lug.
- Bolts and Nuts.

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27 2 amp Line Filter	43/4
22 5 amp Line Filter	60/
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PART No. 582

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- 470 uh Choke Part No. 430.
- RF Coil, Part No. 252.
- OSC Coil, Part No. 248.
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- 2nd IF Part No. 146.
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253 Car Aerial Coil	/6
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174 Single Tuned IF 455 Kc ..	/4
175 Single Tuned IF 455 Kc ..	/4
176 Double Tuned IF 455 Kc ..	/4
177 Double Tuned IF 455 Kc ..	/4
178 Double Tuned IF 455 Kc ..	/4
179 Transporta 4 IF	/8
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146 2nd Car Radio IF	/8
147 3rd Car Radio IF	/8

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562 RF Section Transporta 7 ..	)/
569 Audio and RF Section Transporta 4	)/
568 TV Video Strip R. and H. ..	0/
567 RF Stage 3 gang Transporta 7	0/
580 Car Radio	0/

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ransistor Output
ransformer 20 ohms
r 5 ohms to 3.5 ohms.
ransistor Driver
ransformer 8,000
hms to 20 ohms.
iniature 3-gang tun-
g Capacitor. ("H"
w).
ircuit board. (See
xt).
etal Case and heat
nk assembly.
ial bracket assembly.
55 Kc/s Transistor IF
ansformers.
F coil kit comprising
erial, RF and oscil-
tor coils.

TRANSISTORS

2N1107, 2N1108,
1110, 2N1111, TS14,
14-Z, 2N250 and
4 or similar.

CAPACITORS.

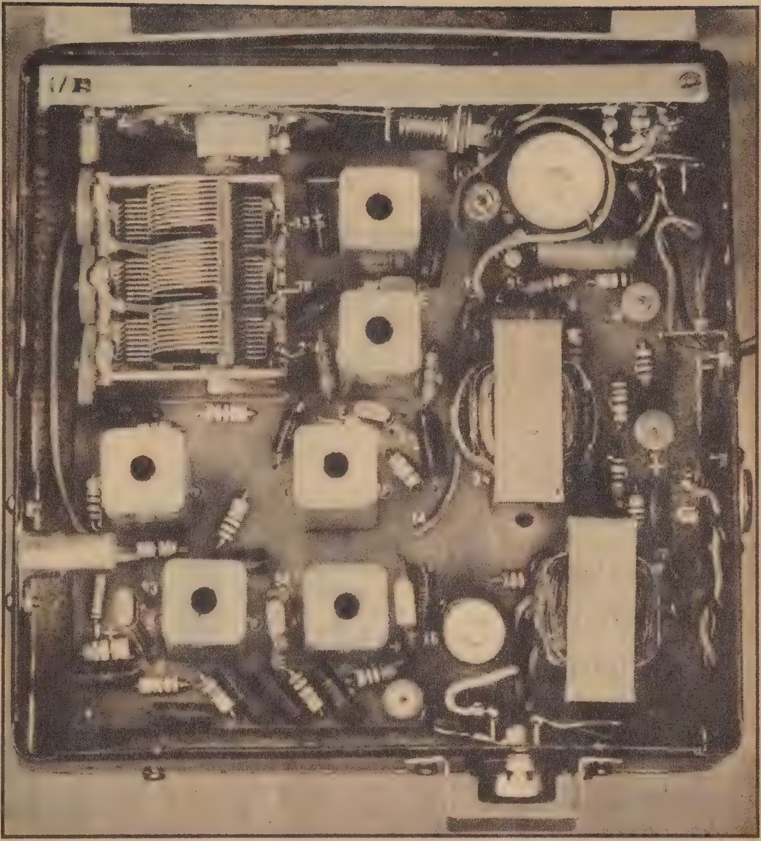
90 pF plastic.
.005 mfd plastic.
.02 mfd paper.
.04 mfd paper.
0 mfd 3v. electro.
0 mfd 25v. electro.
50-500 mfd 18v.
lectro.
00 mfd 3v. electro.

RESISTORS.

ohm ½ watt.
0 ohm ½ watt.
2 ohm ½ watt.
50 ohm ½ watt.
00 ohm 1 watt.
30 ohm ½ watt.
70 ohm ½ watt.
80 ohm ½ watt.
K ohm ½ watt.
.5K ohm ½ watt.
.2K ohm ½ watt.
.3K ohm ½ watt.
.9K ohm ½ watt.
.7K ohm ½ watt.
.6K ohm ½ watt.
0K ohm ½ watt.
7K ohm ½ watt.
9K ohm ½ watt.
7K ohm ½ watt.
00K ohm ½ watt.
olume control pot., with switch.
10K log with low hop-on.

MISCELLANEOUS

3 Mica trimmers, 4 only ⅜in grommets, aerial connector, speaker connector and plug, lead type fuseholder and 5 amp cartridge fuse, knobs, pilot lamp and holder, wire, screws, etc.



This view of the top of the assembled board shows the layout and major components. Note the power transistor at the lower right with its protective shield and the three trimmers soldered to the frame of the tuning gang. The aerial cannector at the left is a small single-contact bayonet type.

; to make feedback design a prob-
While, from the viewpoint of gain,
ity and distortion correction, it is
ble to run as close as possible to
afe limit of feedback stated above,
olicy may easily result in instability
transistors near the high end of
ain spread.

ded to this is the fact that routine
stor amplifiers commonly use two
ormers inside the feedback loop,
r of them designed to critical high
y standards.

en together, these factors make it
ble to recognise a "safe" limit well
the 20 dB. mentioned earlier, re-
ering that this new limit should
e exceeded by an accidental com-
on of high-gain transistors inside
edback loop.

nufacturers of receivers and ampli-
can usually control things fairly closely, because they use a specific type of transformer, they can select and relate transistors having appropriate orders of gain and can check the end result.

In the case of individual constructors, and particularly those lacking elaborate test facilities, it is not wise to take liberties.

Accordingly, we must adopt the course of recommending a set of audio transistor types (particularly those within the feedback loop) for which there is little possibility of embarrassing loop gain occurring. Such a set is the S.T.C. types 2N250 and TS14-Z, which we have shown in the circuit. Another set would be the Ducon type SFT 213 output transistor used with either the SFT 152 of the same brand or the S.T.C. TS3-Z.

Obviously, for readers having adequate testing facilities, it is quite feasible to use other types and combinations. The main point to watch is that the gain of the two should not be sufficient to cause either an audible or supersonic oscillation. If this occurs, one or both of these transistors may be damaged.

Thus, if you intend trying a combination other than those suggested, fit a CRO to the output and commence testing with a reduced supply voltage, to be on the safe side. Watch for "sacs" of oscillation on the audio waveform as the output approaches maximum.

WIRING BOARD

The complete circuit is built on a printed wiring board approximately 5¼in x 5¾in. This has a small dial assembly mounted on one end, supporting the volume control. The complete assembly then fits into the case, which is made from two strips of sheet metal bent into "U" shapes, and a lid top and bottom. The board and dial assembly is supported inside the case by two screws at the rear and the spindle bushes at the front.

We suggest that a square of plastic foam sheet, ¼-inch thick, be cemented to the lower lid, so that it will provide support for the centre area of the board when the lid is screwed in place.

To provide adequate heat abstraction from the power transistor, the

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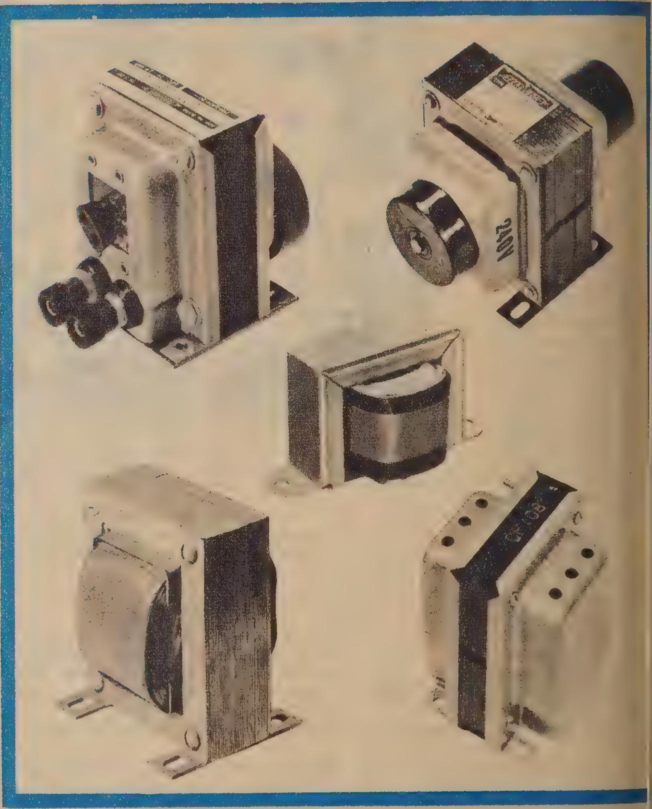

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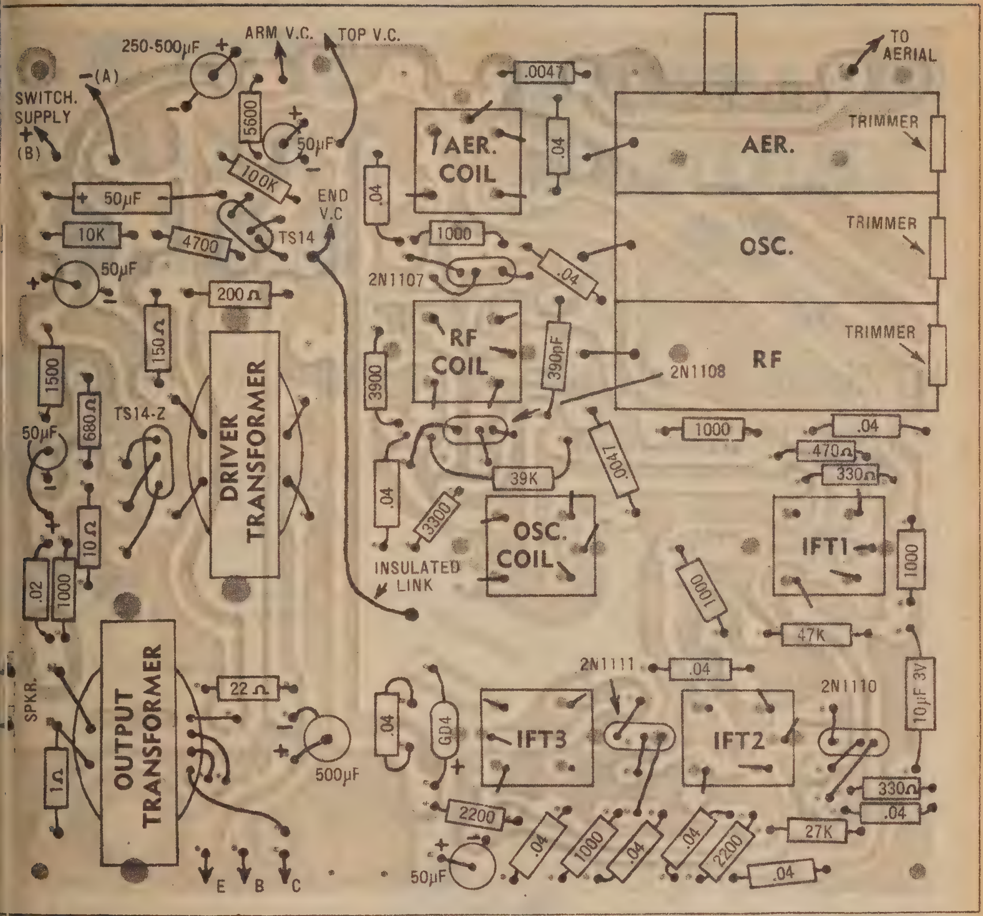
ARM V.C.
TOP V.C.
250-500µF
–(A)
SWITCH. SUPPLY
+(B)
5600
50µF
100K
50µF
10K
4700
TS14
END V.C
.04
1000
2N1107
AER. COIL
.0047
.04
TO AERIAL
TRIMMER
AER.
TRIMMER
OSC.
.04
TRIMMER
RF
2N1108
390pF
RF COIL
3900
50µF
200Ω
150Ω
1500
680Ω
TS14-Z
50µF
DRIVER TRANSFORMER
10Ω
.02
1000
39K
.04
3300
.0047
OSC. COIL
INSULATED LINK
1000
.04
470Ω
330Ω
IFT1
1000
1000
47K
SPKR.
OUTPUT TRANSFORMER
22Ω
1Ω
500µF
E
B
C
.04
GD4
IFT3
2N1111
.04
IFT2
2N1110
10µF 3V
330Ω
.04
27K
2200
50µF
.04
1000
.04
.04
2200
.04

lere is a view of the printed wiring board, reproduced approximately full size. It is viewed from the copper or 'nderside, with the various above-board components super-imposed to aid in wiring the circuit. Note the oscillator uning section of the gang between the aerial and RF sections to minimise coupling between the two.

ear "U" of the case must be made rom copper sheet. This is done ecause the copper with its high onductivity is able to provide ıster transport of heat from the 'ansistor than a comparable area nd thickness of iron sheet.

small sheet metal bracket is faened to the rear of the case over h power transistor, to protect it from ocible damage. The open construction al ws this without seriously reducing the flo of ventilating air around the case of he transistor.

LYOUT POINTS

or readers wishing to copy the recommended layout and construction, he; are a few points to help in the m ter of assembly of components on th board.

irst mount the tuning gang on the bo d via three screws and the tapped ho in the frame of the gang. Then mo nt the oscillator coil can and the al o driver transformer. Follow by mounting all the minor components, and fir ly the output transformer and remaining coils and IF transformers.

The dial bracket may then be mounted, fitting the drum coupling via an insulated bush to the gang spindle. The volume control may then be fitted to the bracket, completing the board assembly. This is then mounted in the basic frame of the case, by slipping a 1/16in washer on each spindle bush and passing them through the holes in the front of the case.

The dial escutcheon is then passed over the two, and the whole fastened together with a nut on each threaded spindle bush.

At the rear of the board, the mounting is completed by a screw and nut at each corner. The main point to watch during the mounting of the board in the case is that at NO POINT should the wiring of the board contact the case. Use fibre insulating washers where necessary, and note that the feet of the dial bracket mount on TOP of the wiring board, not beneath it.

It is also wise to keep the transistor leads at a reasonable length, insulating them where necessary with plastic sleeving. The normal care as regards preventing the transistors from being overheated during the soldering process should be observed.

With the board mounted in the case, it is possible to mount the various connectors also, and the power transistor may be fitted. As the diagram shows, care should be taken to ensure that the case of the transistor does not make contact to the case of the set. The mica washer supplied should be placed between the two, and bakelite bushes used to insulate the fastening screws from the main case. One screw is fitted with a solder lug under the nut to allow the collector connection to be made.

ALIGNMENT

Now for a few words about lining up. The procedure is relatively simple, since single-tuned transformers are used throughout.

The first thing to do is align the IF transformers. This may easily be done by feeding 455 Kc/s from a signal generator via a capacitor of about 0.01 mfd into the mixer collector, preferably at the junction of the 330 ohm resistor

(Continued on Page 64)

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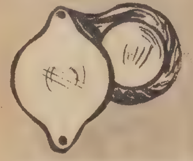

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22/6
(5/ Delivery to Rail)
Aerial Bases, 12/6

Telescopic Rifle Sights

With windage and elevation adjustment, blued lens and clamps. Supplies 4 magnifications.

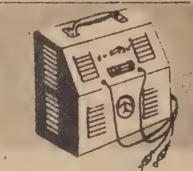
£8/15/-
(Post 4/6)

Jeweller's Screwdrivers

Set of five, 13/9
(Post 6d)

MAGNIFYING GLASSES

Folding pocket glass (illustrated), 8 magnifications DOUBLE LENS.
15/ (Post 1/)
Round Reading Glasses
(Post 1/6)



ARMY CLINOMETER

For grading, levelling, etc. Supplied in leather carrying case.

25/-
(Post 4/6)

SLIDE RULES

Circular concise pocket rule. 17/6.
Straight edge with electrician's scale. 55/.
Large circular slide rule 22/6
(Post 1/)

Tapped Transformers

6-12-18-24-32 volt 2 amp 52/6
6-12-18-24-32 volt 3 amp 59/6
6-12-18-24-32 volt 6 amp 75/
230 volt-110 volt
300 watt £7/7/
(5/ Delivery to Rail)

ARMY SPOTLIGHTS

Ex-army Lucas spotlights, 6 volt, ideal for boat or car.

50/-
(Post 3/6)

JEWELLER'S EYEGLASSES

Single lens, 10/6
Twin lens, 15/-
(Post 6d)

PRIMUS STOVES

Large, army primus stoves, complete with windshield. Brand new at just

£2/10/0
(5/ Delivery to Rail)

Rifle Spotlight

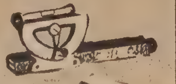
Fits rifle or gun barrel. Sealed beam — 6 volt.

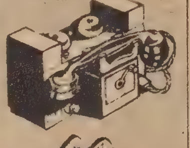
83/6
(Post 3/6)

BATTERY CHARGER

6 and 12 volt 4 amps unit, complete with ammeter to show rate and completion of charge.

£7/15/0
(5/ Delivery to Rail)
Available Melbourne Shop Only.





22 TRANSCEIVER

2-8 mcs. Complete with 12 volts power supply, leads and headphones.

Reduced Price
£12/10/0
(5/ Delivery to Rail)

POCKET COMPASS

Brass housed pocket compasses.
Large 12/6, Medium 7/6
Small 2/6
(Post 6d)

ABNEY LEVELS

A simple hand dumpy level with hairline sight and vernier scale. Suitable for ground levelling, tennis courts, etc.

£7/10/0
(Post 3/6)

TELEPHONES

Famous ex-army "F" phone for extensions to outer sheds — barns — offices — shop to factory — etc. Cheaper than P.M.G. extensions, no yearly rental.

£4/9/6
(5/ Delivery to Rail)

22 GAUGE WIRE

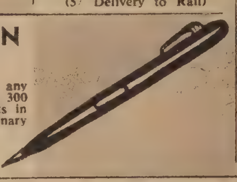
Plastic covered wire, 3,000ft. on a handy reel. Ideal for all gardening uses, binding, electric bells, burglar alarms, clothes lines, etc

7/6
(5/ Delivery to Rail)

A. C. NEON TESTERS

Checks existence of any power between 80 and 300 volts AC inclusive. Fits in the pocket like an ordinary fountain pen.

6/6
(Post 1/)



TELEPHONE HANDSETS

Standard telephone replacement sets suitable for adapting to your own internal telephone system.

19/6 each.
(Post 8/6)

LINEN TESTER

Also ideal for stamp scrutinising. Very powerful magnifications

12/6
(Post 6d)

PORTABLE TRANSMITT

Complete with 6ft telesc
aerial.

7/6
(Post 3/6)

LARGE TOOL ROLL

For car or tractor tool
Measures 4ft x 1ft 6in

7/6
(Post 2/)

RECORDIN TAPE

1,200ft spools of twin
recording tape on sta
7in plastic reels.

29/6
(Post 3/6)

TAPE SPOOLS

3in spools
5¾in spools
7in spools
(Post 1/6)

RELAYS

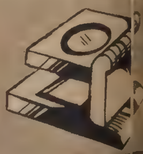
3,000 TYPE: Wide ran
coil resistances for
50,000. Prices from 1
600 TYPE: 200 ohm
ohm, 600 ohm, 10/6 e
Large range of other
from 6 to 250 volts
wide ohm selection
combinations—from 10
Sorry, No Mail Orde
these—please call and

DRAWIN SETS

4 piece set .. .. ..
8 piece set .. .. ..
Deluxe 8 piece set ..
All supplied in be
cases.
(Post 2/6)

PERSPEX

6in x 20in .. .. ..
12½in x 20in .. .. ..
12½in x 40in .. .. ..
12½in x 17in .. .. ..
25in x 20in .. .. ..
25in x 40in .. .. ..
3ft x 4ft .. .. ..
(5/ Delivery to R

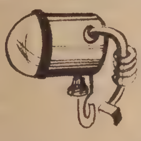


WALTHAM TRADING CO.

, OXFORD ST., SYDNEY — 243 RUNDLE ST., ADELAIDE.

229 ELIZABETH ST., MELBOURNE

'ROUBLE LIGHT



lsend. for your car. e it in the glovebox c for use immediately. on to car battery or power supply.

7/6
(Post 2/6)

AMPLIFIERS

powered units suitable for No. 11, 19, or 22 ivers. Approximate output is 30 watts. Complete enemotor and vernier tuning dial.

£5/0/0 (5/ Delivery to Rail)

WILLIAMSON AIRCRAFT CAMERA

.F. 16mm Aircraft Camera, New £5
DRASTICALLY CUT TO (second hand) 59/6
(Post 10/)

ANIFOLD RESSURE GAUGE

read 10 inch vacuum, ch pressure. Checks efficiency to improve fuel consumption
25/ (Post 3/6)

2-VOLT UTOUTS

9/11 (Post 2/6)

TO PLIERS

f three pliers for and carburettor adjustment. Comes in plastic
12/9
(Post 2/6)

HIELDED WIRE

volt four core.
1/- per yard
st 2/ any length)

)BBY KITS

to make working d, complete with instructions
ar kit 7/6, Motor kit 6, Bell kit 5/6.
(Post 6d)

ircraft Kits

ete pre-cut, ready for ly and supplied with electric motor and ale plans.
£2/2/ (Post 3/6)

AUTO Temperature GAUGE

Fahrenheit scale, reads 100 to 220 deg. Complete with lead.

39/6
(Post 4/6)

BATTERY CHARGER KIT

Charge your own battery while it's in the car. 6 and 12 volt 5 amp rectifier and transformers.

£5/12/-
(Delivery to Rail)

Spark Plug Suppressors

1/9 each
(Post 6d)

Wobbulator

For TV testing, frequency modulation.
New reduced price
32/6.
(Post 3/6)

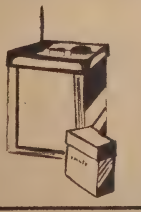
EF50 SOCKET

1/6 each
(Post 6d)

VALVES

A	7/6	6F8	12/6	12K8	12/6	1632	12/6
A	7/6	6G6	5/11	12SC7	12/6	1638	7/6
B	7/6	6H6	1/6	12SJ7	9/6	1639	7/6
D	5/	6J5	12/6	12SK7	10/6	2051	15/
F	10/6	6J6	12/6	12SR7	4/6	7193	1/6
G	7/6	6J7	12/6	15R	15/	9001	7/6
H	3/9	6K6	6/9	25L6	12/6	9006	7/6
J6	5/	6K7	3/11	27	10/6	AR8	7/6
K	3/9	6K8	6/9	37	10/6	AV11	1/11
K	7/6	6L7	3/11	85	10/6	CV21	7/6
K	3/6	6N7	9/6	117N7	7/6	CV65	4/6

ORTABLE ANSCEIVERS



8 set, complete with ones, microphones, control box and spare valves. Approximate two miles.

£5/12/6
Delivery to Rail)

HEARING AIDS

Pocket hearing aids. Complete with lead, plugs and earphones. Clips inside the pocket 35/
(Post 2/6)

CARBON MIKE

Carbon microphone in bakelite case 4/6
Hand carbon mike, Bo. 3, with on and off switch 6/6
(Post 3/6)

CRYSTAL INSERTS

for carbon microphones.
15/ (Post 6d)

WIRE CUTTERS

Extra strong. Will cut tough grades of fencing wire effortlessly.

7/6
(Post 2/6)

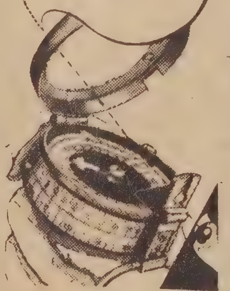
PRISMATIC COMPASS

Extremely accurate, oil filled compass, complete with prismatic sight for taking bearings.

£8/10/-

DRY CARD COMPASS: Identical to the above but has dry reading.

£1/19/6
(Post 4/6)



BREAST MIKES

With neck strap and mouthpiece.

5/-
(Post 4/6)

TELEPHONE WIRE

Two mile drums of telephone wire.

£3/0/0
(5/ Delivery to Rail)

TWEEZERS

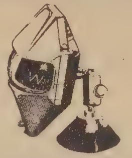
Small, 2/6
Large, 5/-
(Post 6d)

CONVERTER

24 volt DC input, 240 volt AC output.

£12/10/-
(5/ Delivery to Rail)

CAR COMPASS



Ideal for car trials. Fits securely to the dashboard by means of a suction cup mounting bracket. Complete with built-in compensation box.

49/6
(Post 4/6)

BOOKS ON RADIO

No. 153 Portable Miniature Oscilloscope	3/9
No. 155 Portable Transistor Radio and 'Gram ..	3/9
No. 159 Realistic Hi-Fi	7/6
No. 161 Radio, TV and Electronics	5/3
No. 163 Transistor Circuits Manual No 2	3/9
No. 165 Radio Tuners	7/6
No. 152 Transistor Car Radios	3/
No. 166 Public Address Systems	3/9
No. 168 Transistor Circuits Manual No. 4	3/9

(Post 1/)

DIALSIGHT

360 degree calibration with prismatic sight. Army rangefinder with 360 degree movement and gunsight. Complete with Lucas tripod £3/15/
Endless uses.
(Post 10/)

Super Sanwa Multimeter

Just arrived these famous Sanwa Multimeters. Sensitivity 2,000 ohms per volt. Checks all voltage from 0—1,000. Also 0—500 micro amps. 0—500 milliamps and plus/minus 20 decibels.

£5/19/6
(Post 8/6)

MINIATURE MOTORS

Work your models from 3 volt batteries.

Model 45 ...... 8/6
Model 55 ..... 10/6
(Post 1/6)

MINIATURE OUTBOARD MOTORS

They look like the real thing and will operate your model boats from ordinary three volt batteries.

29/6
(Post 1/6)

CRYSTAL SET PARTS

Miniature cabinet, 7/6
Headphones 27/6
Crystal earpiece .. 10/-
Germanium diode, 7/6; Slug tuned coil, complete with knob, condenser and circuit, 16/6; Aerial wire (100 feet), 3/6; Terminals. 1/ each; The Boys' Book on Crystal Sets, 3/9 (postage 3/6 per part, 5/ per set).

LOW RESISTANCE Headphones

BRAND NEW! Suitable for use with recording tape, radio, etc.
PRICE CUT TO 12/6
(Post 3/6)

CAMEL HAIR BRUSHES

Beautifully smooth, top-quality camel hair mop brushes for only 17/6 each. They're far dearer elsewhere. (Post 2/)

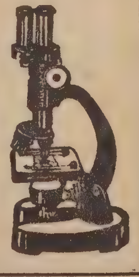
VERNIER DIAL

Geared tuning dial with provision for normal and super-fine tuning.
PRICE CUT TO 9/11
(Post 3/6)

TELESCOPES

Pocket Telescope: It folds into a pocket-sized pigskin case and opens into a powerful glass offering 25 power magnifications. Ideal for tourists. £3/19/6
(Post 4/6)

MICROSCOPES

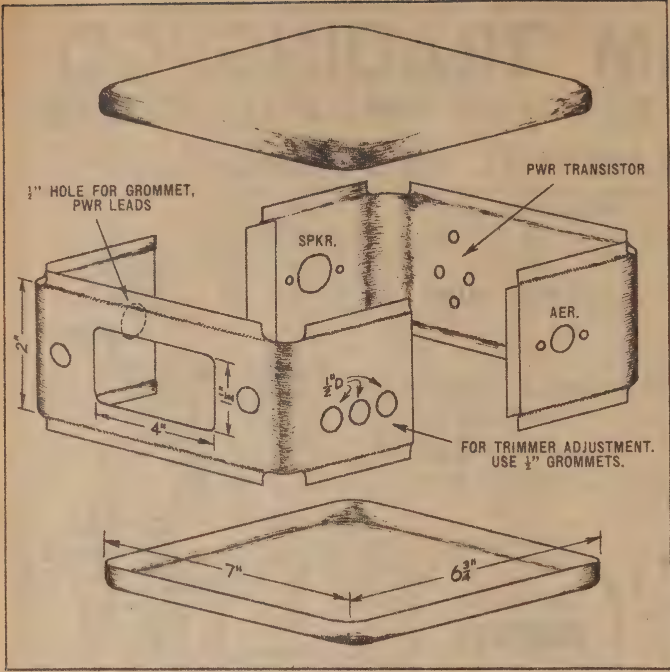


TWIN LENS: Supplies from 80 to 600 magnifications. Complete with slides and built-in lighting. Supplied in a wooden box.

£6/19/6

SINGLE LENS: Supplies 100 to 300 magnifications. Ideal for studies but they're good fun, too. Supplied with slides in a polished wooden box.

£3/19/6
(Post 8/6)


½" HOLE FOR GROMMET, PWR LEADS
PWR TRANSISTOR
SPKR.
AER.
2"
4"
½"
½"D
FOR TRIMMER ADJUSTMENT. USE ½" GROMMETS.
7"
6¾"

Here is an exploded sketch of the case, showing the main dimensions. The exact size of holes for speaker and aerial sockets will depend upon the types used, and are accordingly not specified. Note that the rear "U" of the case is made from sheet copper, to provide adequate heat abstraction from the power transistor.

and the oscillator tickler winding. With the generator or oscillator set for modulation, the transformers may be adjusted to optimum by listening for a maximum in the speaker.

Start with a quite high input, and adjust transformer IFT3 first. Then reduce the input and peak up IFT2. Finally reduce the input to about 30 microvolts and peak up IFT1. This completes the IF alignment.

Now for the front end. This time connect the signal generator (fitted with a dummy aerial) to the aerial connector of the set via the ignition choke. In addition, shunt the aerial connector to earth via a 47 pF ceramic capacitor. This takes the place of the capacity of the shielded cable used between aerial and set in the car, and duplicates final conditions. It is most important that this be done, as difficulty with alignment may otherwise be encountered.

FIRST CHECK

First of all, set the generator and the receiver dial to 700 Kc/s. Then tune the local oscillator by means of the coil slug until a sound is heard in the speaker, leaving the slug at the position producing a maximum. The RF and aerial coil slugs (in that order) should now be adjusted for maximum volume, reducing the input signal as required to maintain an output of only about 50 milliwatts with the volume control on maximum.

The oscillator and receiver dials should now be turned to 1200 Kc/s. This time the middle or oscillator TRIMMER of the gang should be adjusted for a peak, and the final adjustment made with the RF (rear) and aerial (front) TRIMMERS. Note the procedure: at the low-frequency end, the coil slugs are used, and at the high-frequency end, the trimmers.

Finally, return the generator and
to 700 Kc/s, and make sure that
tracking there is still optimum
rocking each coil slug slightly.
this performed the set should be corre
aligned.

The matter of interference suppres
should now claim our attention. As
circuit implies, the aerial lead shoul
fitted with a small choke. This shoul
mounted at the aerial end of the ca
between the base of the rod assembly
the cable. Suitable chokes are avail
from a number of manufacturers,
cluding R.C.S. Radio Pty. Ltd.

POINTS TO WATCH

The leads connecting the speake
the set should be shielded if they
longer than about a foot. A suit
cable for this purpose has two i
conductors enclosed by a shield b
with a final rubber covering for
tection. Note that if this is not
the best plan is to use ordinary "fig
eight" plastic lighting flex.

Probably the most important sec
requiring suppression is the power su
from the battery. Usually there wil
at least a rudimentary filter circuit
quired in these leads just before
enter the set.

We suggest that you try a simple
using an inductance consisting
dozen odd turns of 20 SWG enam
copper wire wound round a piece o
former in conjunction with a 0.1
ceramic capacitor. The inductor sh
be placed in series with the active ba
lead close to where it enters the set.
the capacitor from the receiver en
the inductor to the case.

ERRATA

**Due to an unfortunate chain
circumstances the circuit of t
"Twin Ten Watt Unit Ster
Amplifier" of the May issue sho
ed the main HT line voltage a
330.**

**In fact this should not be
lowed to exceed 315 volts and,
a transformer of the order of 1
volts is used, sufficient resistan
(approximately 100 ohms) shou
be added to the circuit to redu
the HT to this figure.**

**Alternatively, it would be bet
to use a transformer of around 1
volts which is available in
least one brand.**

A filter of this order should be
quate in most cases, along wit
usual distributor suppressor and a
at the generator. For more di
applications, however, it may be
sary to fit a somewhat more elab
filter.

LITTLE RESISTANCE

The main point to watch with
for this position is that they invol
little DC resistance as possible, sinc
resistance will result in loss of v
reaching the set and consequent
regulation.

A typical commercial filter fo

PRACTICAL
HOME-STUDY
COURSE IN RADIO

STOTT'S Course meets the exact needs of Amateurs, Radio Salesmen, Experimenters, Dealers, Service Men, Builders of Sets and others.

This popular Course has been designed and prepared by experts.

A N.S.W. student wrote:—

"The lessons are simply explained and anyone, without any knowledge of Radio, can follow them quite easily."

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CUT HERE AND POST

TO STOTT'S: Please send me, free and without obligation, full particulars of your Course in Radio for Amateurs.

My Name ....

Address ....

.... Age .... (R.H. 861).

plication employs three series chokes, o being of the air-cored RF variety. ese have about 30 turns of 18 SWG amelled wire wound on a small ½in e bobbin. The third choke is wound a small laminated core similar to a all speaker transformer and using the me gauge wire to almost pack the ailable winding space. All three are ed in series with the active lead, with 1.0 mfd. 100-volt paper capacitor nting the receiver end to earth.

This particular unit is available in a all case ready for mounting in a posin close to the set. While it and other ers are readily available, we include above information to enable erested readers to construct their own.

You may notice that we have not cribed a case for the speaker. This is cause many cars are fitted with a table grille as part of the dashboard, ich provides a ready-made mounting the speaker. For cars not having this vision, the actual case used will still pend to a large extent upon the desired ition of the speaker, and the available ce.

FT TO INDIVIDUALS

Thus we have left the matter of a aker case to each constructor. If the ilable space warrants a more or less ndard, square speaker box, there are number of these available comrcially. Remember that the quality reproduction will normally improve the size of the speaker is increased the efficiency of the baffling.

uch is our new car receiver, which uld prove most suitable for a wide iety of cars. In tests we have put hrough, it compares most favourably h commercial receivers.

HERE'S YOUR ANSWER, TOM!

(Continued from Page 43)

ut terminals, is a larger winding than secondary, and is fitted with a nber of connections at various parts the winding called taps. These taps w the amount of actual primary ding used to be varied, to vary the arent input resistance of the device.

he resistance reflection ratio depends n the square of the ratio between primary winding and the secondary. other words, if the amplifier under requires a load resistance of four s the value of R1, the ratio of ary turns on the transformer to ndary turns must be adjusted to 2:1; e the number of turns on the nary. If a value of one quarter R1 equired, the primary turns would l to be half those on the secondary.

other words, the matching transner provides a simple means of ching the load resistor R1 to any ice requiring another value of load tance for optimum results. It has igible effect upon the power fed to resistor and meter circuitry.

his concludes our discussion of audio ortion and power measurement, Tom. t month, we will discuss the circuit nification or "Q" meter, used to ermine many parameters of L-C d circuits.

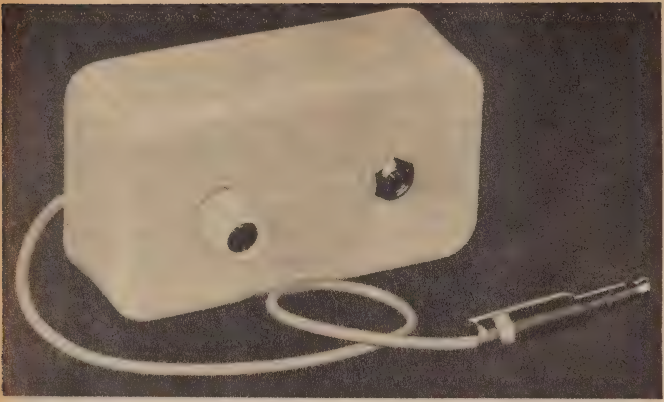
FREE OF CHARGE
If you call on us or write for advice on
HI-FI EQUIPMENT OR TAPE RECORDERS
NO OTHER FOUR TRACK STEREO RECORDER CAN MATCH THE PRICE AND PERFORMANCE OF OUR
KORTING MODEL 128
An amazing single speed unit (3¾ I/S) with amazingly low wow and flutter and a frequency range of 30-16,000 cps enables you to make true studio quality recordings at a very low price. PRICE LESS MIC. .. .. ONLY £156/10/-
The Amazing KORTING MODEL 157
Features such professional performances as synchronous dubbing, monitoring, trick and echo recordings 2 speeds 3¾ ips. and 7½ ips. with a frequency resp. of 30-16000 cps.
Write for leaflets or ask your dealer for a demonstration. References from all over Australia give full credit to these machines which are truly highlights of electronic engineering.
HI-FI EQUIPMENT *World Famous*
EMPIRE 88/108 CARTRIDGES
GRADO BALANCED PICKUPS
SPECIFICATIONS:
GRADO MASTER STEREO CARTRIDGE
- Freq. resp. 10-30,000 cps.
- Stylus mass .8 milligrams.
- Output 5mv per channel at 10 cmv.
- Impedance 700 ohms per channel.
- Tracking force 3 grams.
- Channel sep. excess 25 db.
- Radium active element life 3,200 years.
- Fits all standard arms.
PRICE £52/5/2
EMPIRE 98 STEREO/BALANCE TRANSCRIPTION ARM
- Calibrated knob 0-8 grams.
- Dynamic balance assured.
- Maximum vertical and lateral compliance.
- Resonance below audible threshold.
- Self latching arm rest.
- Interchangeable cartridge shell with four gold-plated contacts accepts all standard cartridges.
- Lowest possible tracking error.
- Choice 12in or 16in arms.
PRICE 12in £41
PANTECHNA PTY. LTD.
6a Elizabeth St., Melbourne C.1. Phone MF8811.
N.S.W. DISTRIBUTORS:
AUDIO ENGINEERS PTY. LTD., 422-4 KENT ST., SYDNEY.

JABEL
DO IT YOURSELF
PRINTED CIRCUIT KITS
Comprising copper bonded Sinthane panels, resist paint, etching chemicals, resin.

No. 1 Kit complete with	6x3 panel	.... 11/-
No. 2 Kit complete with	6x6 panel	.... 13/4
No. 3 Kit complete with	12x3 panel	.... 13/4
No. 4 Kit complete with	9x6 panel	.... 16/-
No. 5 Kit complete with	12x12 panel	.... 30/-

Panels only		
	6 x 3	.. .. 3/4
	6 x 6	.. .. 6/
	12 x 3	.. .. 6/
	9 x 6	.. .. 8/4
	12 x 12	.. .. 22/6

ALL PRICES INCLUDE SALES TAX
FROM RADIO TRADE HOUSES EVERYWHERE
Factory Distributors:
WATKIN WYNNE PTY. LTD.
JF2107. 21 FALCON ST., CROW'S NEST, N.S.W.
Interstate: Rollo T. Williams P./L., Brisbane; Distributors Cpn. P./L., Fitzroy, Vic.; F. L. Rungie & Sons, Adelaide; S. T. Lawn & Co., Perth; G. A. W. Wood, Launceston, Tas.



"Big brother" to the midget transistor amplifier described in our last issue, this one uses two transistors, is built into a bakelite case and can be arranged to operate a loudspeaker.

Transistor Amplifier For Small Receivers

This low-powered two-transistor amplifier can be used to boost the volume, as heard in headphones from small radio receivers. Alternatively, by using constants as suggested, it will boost weak signals sufficiently to operate a loudspeaker at modest volume.

DESPITE the ever-increasing complexity of electronic apparatus, it is nevertheless true that considerable interest persists in small-scale projects; in things like crystal sets and the one and two transistor receivers described in our February and March issues. Readers like building such items and experimenting with them.

Having got the best out of a simple set, however, the natural inclination is to speculate whether it can be made better. The urge may be to hear more clearly those signals which are barely audible on the headphones, or it may be to make the signals audible on a loudspeaker.

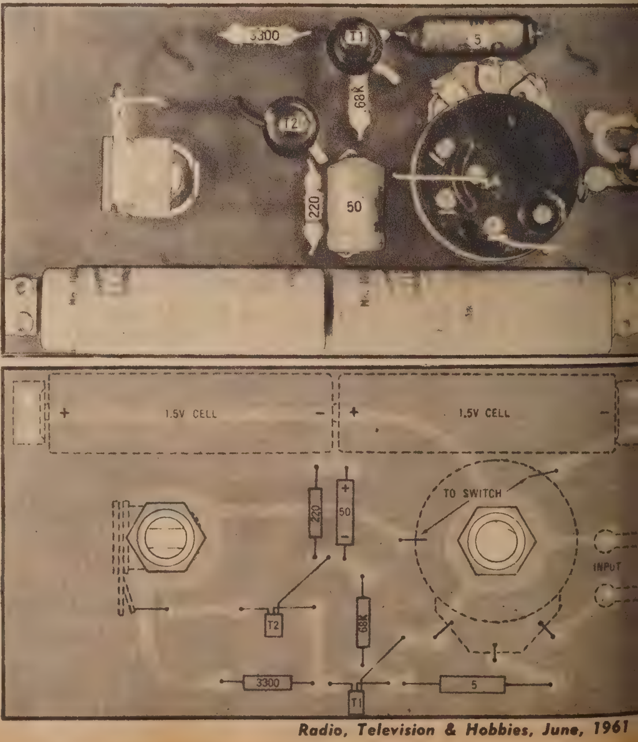
At first glance it might seem that the "or" in the last sentence is out of place; in fact, there is a very real difference between making weak signals louder in headphones and making headphone signals powerful enough to operate a loudspeaker.

In simple terms this is due to the need for power—real power, expressed in
watts or milliwatts—to drive a lou
speaker. This is not the same as an
plification, of which a small set ma
have plenty, and calls for different ci
cuitry and different transistors. It is n
provided automatically by simply usi
a large aerial or living next door to t
transmitter.

It is the function of this amplifier
provide both amplification and powe
Not a great deal of power, but enou
to operate a sensitive speaker at usef
volume in an ordinary room. (A
remember, a small speaker isn't easier
"drive" than a large one. On the co
trary, a large speaker will normally
much more sensitive than a small on

Although it may take almost any ph
sical form the reader prefers, we ha
presented it as another plug-in unit;
kind of big brother to the one-sta
unit described last month. It has be
constructed in two forms, firstly
matrix board and then on a printed c
cuit board, the details of which are giv
in a separate article in this issue. Bo
layouts will fit into the smaller of t
two plastic cases used in earlier projec

One of the problems of simple c
cuits of this kind is thermal stabili
Transistors are noted for their sensitiv
to changes in ambient temperature a
their tendency to "thermal runaway."
compensate for this, most transistor stag
involve resistor networks so arrang
that an increase in collector current
offset by an automatic decrease in t
forward bias. With two such stag
quite a number of resistors and capa
tors are required. Alternatively, spec
temperature sensitive resistors (therm



You can make a neat job of the amplifier and increase your knowledge in other directions by preparing your own printed circuit board, as described elsewhere in the issue. The composite drawing shows the relationship of the wiring and the components, while the photograph shows the appearance of the unit from the component side.

;) are used in most power output ;es.

n this case we have used another hod, one originally suggested by ndard Telephones and Cables, and d by us in a number of earlier pro- s. This uses direct coupling between stages, the first operating as a low- l amplifier and the second as a power plifier. By reason of the direct coup- the temperature coefficient of each isistor is made dependent on the er.

he forward bias on the base of T1 ies from the emitter of T2. Transistor draws collector current through its 0 ohm load and the same potential ch exists at the collector is applied to base of T2. The effective for- d bias on T2 is the difference between potential and the potential developed oss its own 220 ohm emitter stor.

NEGATIVE FEEDBACK

n this circuit, any increase in the rage collector current of T2, due to bient temperature rise, will produce corresponding increase in potential p across the 220 ohm emitter resistor. s will increase the negative bias at the e of T1 producing an increase in the ector current. Thus, T1 collector and base voltage shift towards earth, tend- to offset the original change in T2 ector current.

n practice, due to this protective ure of the direct coupled circuit, the ector current in T2 decreases with an ease in temperature. However, it have to be much hotter than normal re the power output is decreased by significant amount.

nd in case you're wondering how can tolerate a temperature and ent rise in T1, while we strive to vent this in T2, the answer is that operating conditions of T1 are far critical than those of T2. Being a stance coupled stage, protection is vided by the 3,300 ohm collector resistor and the general operating ditions, which are such that they will ain well below the maximum per- ible dissipation ratings.

IABLE CIRCUIT

his circuit has been fully proven in ier projects using transistor types and 2N185 for T1 and T2, respec- vy. The types we have in this ampli- e are two comparable Ducon types, ely, SFT151 for T1 and SFT123 for As shown in the circuit, an OC70 n OC72 in combination also may be s.

or the output transformer we recom- d using the type designed for the inal "Transporta" receivers, ignoring centre-tap. This can be mounted on loudspeaker frame as we have done, if planning a different layout, can ncluded on the main circuit board.

he first circuit on page 68 gives the ponent values for the amplifier when to drive a loudspeaker. Total cur- drain under these conditions is oximately 6mA, and, when the sup- is increased to 9 volts, about 19mA, nding upon the transistor types be- used.

r those constructors who wish to this amplifier to drive a pair of phones we have included a second uit, showing the resistance values ble for high impedance phones. In circuit the values of both T1 collec- oad resistor and T2 emitter resistor

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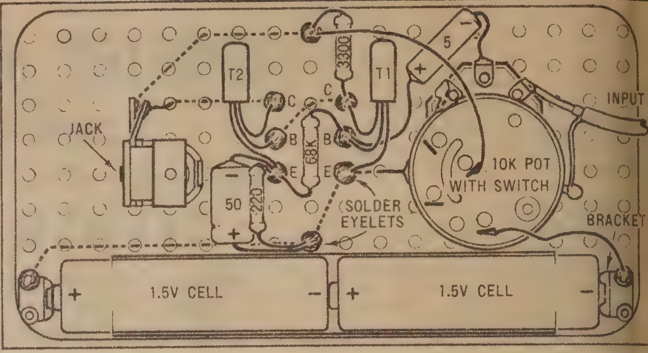


If you are not inclined to build the printed circuit version, the components can be assembled, as indicated here, in a piece of matrix board.

have been increased to maintain suitable bias conditions on both stages. If you desire to use low impedance phones the value of T1 collector load should be approximately 6,800 ohms and T2 emitter resistor 220 ohms.

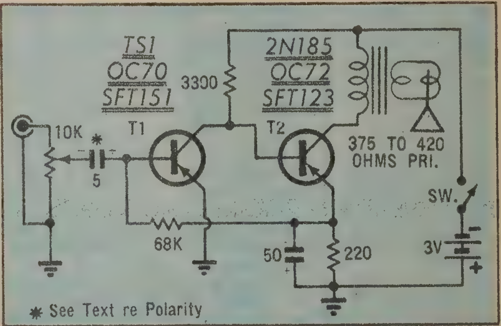
When driven by a crystal set connected to a large aerial in a favourable locality, the amplifier has considerable reserve gain under both of these headphone conditions.

In high signal strength areas this gain often may be used, indirectly, to improve selectivity. Without the amplifier the selection of tappings on the aerial coil needs to be a certain compromise between sensitivity and selectivity, often not a very satisfactory one. With the amplifier added, sensitivity can be sacrificed in the interest of selectivity and a much more favourable compromise achieved.

In more remote areas, particularly if selectivity is not such a problem, t gain may be used in a more direct ma ner to boost signals previously too we to be useful.

Coming to the construction, the st of matrix board used was 4½in by 3/8in (18 holes by 9 holes), with t four corners filed away to enable it fit neatly into the back of the case. T volume control and output jack a mounted through two ⅜in holes and t plastic case is then drilled to correspo with these. The board is held in t case by screwing additional volume co trol and jack nuts on the outside the case.

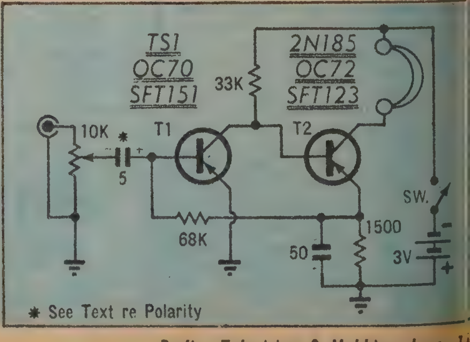
As in previous designs, the compo ents are anchored to eyelets riveted the appropriate holes, and a total of are used altogether. Tinned copper w strapping on the under side of the boa completes the wiring.



✱ See Text re Polarity

If you want drive a lou speaker, t h amplifier shou be wired us the compon values shown left. Note t the output tra former should a transistor ty If a 9-volt batt is used (see te it would need be large enough stand the batt drain.

For use with earphones, the constants should be used as at the right. There is no point in using a higher voltage battery but the constants should be chosen according to whether the phones are low impedance (say 400 ohms or less) or high impedance (say 2000 ohms or greater).



✱ See Text re Polarity

ie battery consists of two 1.5 volt il torch cells in series, held between copper brackets, one riveted to each of the Matrix board. The cells are together in a celluloid tube, in this "scrounged" from a commercial istor set. However, the home builder ld be able to make a suitable tube cardboard or by rolling the cells short length of brown paper.

iose readers interested in construct- the printed circuit board described here in this issue will find the following details helpful in assisting them to plete the wiring of the amplifier in second form.

LLING THE BOARD

ie first job is to drill the board, and efer to the printed board article for ls as to how this should be done. main point to watch is that all ng etc., should be done from the per side to minimise any risk of age to the copper.

ith the board drilled, attach the bat- contacts and a pair of input lugs, being secured with small eyelets or lar rivets. There probably are y types available which would be ble, but we used the same type as lied for use with the Matrix board. e are Matrix board eyelets type 280, g a plain eyelet, and type 283, being mbined solder lug/eyelet. The for- is used for the battery lugs, the r for the input terminals.

acement of the wiring components uite simple, but we have prepared a ut diagram showing the placement ach relative to the copper pattern. component pigtails should be push- hrough the board, bent over to hold components in place, cut to length, soldered. Take care to apply just igh heat to ensure a firm joint, as essive heat may cause the copper ft.

lux cored solder containing 60 per tin and 40 per cent lead is ideal printed circuit board wiring because ts low melting temperature.

Vith regard to the transistors, we mmend that the leads remain at their length and be covered with plastic hetti. After a double check of the nections they can be soldered into iit last of all with the heat applied the minimum time.

NDING CURRENT

hen the amplifier is ready to switch t would be wise to connect a milli- meter in the T2 collector circuit to k the standing current. Especially 9 volt/loudspeaker operation any iit abnormality which causes exces- current may damage T2 if the over- is prolonged. A fault causing T1 raw too little current will result in condition.

will be found that the currents of T1 and T2 can be varied by alter- the value of the 68K base resistor 1. An increase in value will pro- a decrease in T1 and an increase 2. Best results were obtained when collector current of T1 was set at , making T2 approximately 18-20 depending upon the transistor s.

nally we may consider how this ifier, and the regenerative receiver ibed in the February 1961 issue, be integrated into the one receiver,

(Continued on Page 111)

RCA AR88.LF.
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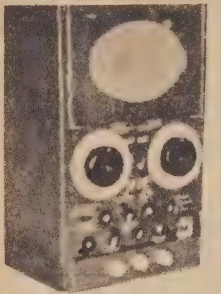

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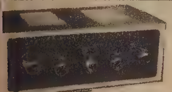

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2 Band, on Fundamentals.
5 to 6 megs.
28 to 40 megs.
Sweep Bandwidth to 12 megs.
Tuner Frequencies on Harmonics.
Prodis Sweep Unit.

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Dual Wave with RF Stage.
8 VALVE, 6BA6, 6AN7, 6N8, EM80, 12AT7, 6BM8, 6BM8 5Y3.
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25 watt, 8 valve, P.A. 240 V.A.C. AMPLIFIER

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FACTORY FRESH GUARANTEED. 90 or 110 degree.

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Twin Track 3¾in Per Second. 2 hour play on L.P. tape. Frequency response 60 to 10.000 C.P.S. inputs for mike. Pickup radio output. For extension speaker. Also to Hi I.M.P. Complete with Crystal mike tape spools, etc. Weight 22lbs.

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15 Watt output extended frequency Ferguson Multimatch Voice Coil. O.P. transformer inputs for crystal mike and pickup with separate mixing gain controls. P.P. EL84 — 6BQ5 output fitted with accessory socket.

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20,000 O.P.V. sensitivity.
Ranges:
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Complete kitset.

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Wired and tested.

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State voltage and battery polarity.

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4-speed.

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Using drift type transistors. Improved range and performance.

KITSET £25/17/6
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Let's Buy An Argumen

—ABOU WORN STYL

If you think that Rip Van Winkle did a good job of sleeping, think again. He has nothing o the tens of thousands of radiogram owners in Australia who are sleeping blissfully on while the sapphire styli in their radiograms are shaving the sound from their prized records And who is to blame? Partly themselves, partly the radio retailers.

By Neville Williams

LET me tell you a story. Recently a friend, who has plenty of clues in other directions, arrived on my doorstep with a request that I try a new record which he had just bought. It wouldn't play properly on his radiogram, the pickup tending to jump grooves. He suspected that there was something wrong with the grooves, though inspection through a microscope failed to show any abnormality.

I duly put the record on my own gear, whereupon it played perfectly from start to finish. My friend was completely non-plussed.

Seeking a possible explanation, I casually asked about his stylus. When last did he replace it?

Stylus? He'd never replaced it. He'd gathered from the salesman, through whom he had negotiated the purchase, that the stylus was permanent. He'd never given the thing a second thought.

I duly explained that a sapphire stylus—as it most likely was — was certainly not permanent. That such styli showed progressive wear and became candidates for replacement at around 100 sides, depending on a variety of factors.

Somewhat disturbed and alarmed, he visited or rang several nearby retailers in an effort to identify and locate a suitable replacement stylus before they closed for the weekend. He was variously "put off" and/or quoted prices ranging from £5 to 26/6. Finally he managed to buy one from somebody's "test bench stocks" for 13/6.

When installed in the cartridge, the new, "troublesome" record played perfectly.

Thoroughly intrigued, my friend asked me about the proper dimensions of a new, unworn stylus. Since the radiogram involved was a relatively new stereo model, I suggested that the stylus would probably have a tip radius of about 0.7 mil. or .0007 inch.

When next I saw him, he had spent some time comparing the two styli under a microscope. His words to me were simply:

"If the radius on the new styli is 0.7 mil., then my old one has flats on it 3 mil. long!"

Here's another story for good measure: A friend's suggested that he should be a good fellow and lend people next door a few records for a party to which had just been invited.

My friend showed no great enthusiasm for the mentioning, amongst other things, that he didn't know thing about the pickup in their friend's radiogram or the stylus had last been replaced.

This remark filtered through the female "bush graph" and my friend was ultimately faced by Mr N bour himself.

"What's all this stylus business?" he wanted to know

"My radiogram is fitted with a sapphire and I assured that I could forget all about needle changing."

(CURTAINS).

I would like to think that these stories are the ception but, unfortunately, evidence is very definitely to contrary. They look like being the rule.

Lunching recently with a couple of executives a firm interested in such matters, the subject of pi cartridges and styli somehow came up. It was stated the rate of replacement was very small for both.

The low rate of cartridge replacement (though ba business in one sense) was a sour satisfaction because it indicated degree to which manufacturers overcome the problems of hun and temperature, in so far as they can affect rochell crystals.

The low rate of stylus replacement was another n altogether. Their claim was that, considering the very number of cartridges in use, the rate of stylus re ment, necessitated by straight-out wear, should be times what it actually is.

Since the first story I related was fresh in mi the time (there have been others in similar vein), I to give the matter closer attention. In fact, during a round of the trade in Melbourne, I threw the qu at quite a few people.

Their answer was painfully consistent "If styl ng sold in large numbers, then somebody else is doing selling!"

In short, people are simply not replacing styli at e rate they should be doing so. Therefore, and of cessity, people must be playing records with styli long erdue for replacement and ruining their records as a sult.

Who is to blame for this state of affairs? Well, partly public, partly those in the radio trade who deal the public.

As the foregoing stories indicate, some salesmen (in , most I fear) don't know or don't want to know that phire styli are anything but permanent; that they are ject to wear and require replacement at regular intervals.

OULD SPOIL A GOOD STORY

To say otherwise would spoil a good story and intro- e uncertainties about who is going to effect the re- ement and, if so when, and for how much. So the lic remains blissfully ignorant, by oversight or by design.

I'd like to be able to confine these remarks to sales- who, after all, are not expected to be highly technical ple. Unfortunately, a lot of servicemen and tech- l sales people seem also to have turned their back the problem.

To illustrate this, I have only to refer to a recent versation with a spokesman for one of Sydney's largest ice organisations.

To a question about servicing radiograms he replied: get our quota of faulty pickups and faulty records we replace an occasional stylus."

An "occasional stylus" mind you.

How on earth can anyone pass opinions upon — or demn — cartridges and records, if their awareness of stylus problem is measured by an "occasional" replace- t.

An assessment of quality and performance starts with ylus in good condition. Without this premise, qualita- criticism doesn't mean a thing.

I just wonder how many perfectly good cartridges have replaced for the appropriate number of pounds, when only requirement was a new stylus.

I wonder how many perfectly good records have been ed or set aside as "poor quality" for precisely the e reason?

What are the facts behind this?

Time was when nearly all ups used steel needles, h were supposed to play one side or one record e. Changing needles was ore but, in general, the ic accepted it as part of the e. They were "needle con- is."

STUDY THESE ORIGINAL PHOTOGRAPHS
All these defects cause record wear and bad reproduction
AVOID THEM
INSIST ON A
COLTON
THE PERFECT STYLUS
CHEAPER TO REPLACE THAN RECORDS

A few more warnings to r ord users would not go iss, like this brightly col- ed display card from one of our advertisers.

Attempts to devise longer-life needles produced many rials and many arguments. Chief objection to them that the flats which gradually appeared on the surface f the harder materials were all the better able to age the grooves which they played at the end of supposed life.

With the introduction of microgroove standards, it be- apparent that readily interchangeable needles were doomed. Individual records played for much longer ods and needle chuck arrangements much too bulky t in with new concepts of fidelity. If response was to xtended and resonance pushed up out of the way, the of the stylus assembly had to come way down.

The answer, of course, was the semi-permanent stylus , in most cases, a sapphire tip, by reason of its hard- its cheapness and the relative ease with which it d be lapped to shape.

In short order, just about every mass-produced pick- n the world was equipped with a semi-permanent sap- stylus.

The trouble is that the prefix "SEMI—" has been usly forgotten, overlooked, ignored or despised, till present unfortunate situation has come about—neither public nor the section of the trade who deals with them is awake to the need for regular stylus replacement. Hence my initial reference to the sleep of Rip Van Winkle.

Tale of a stylus . . .

Our tale begins with a salesman
Call him William, or Thomas, or Sam,
Who prided himself that once daily,
He could sell some client a 'gram.

In the midst of the well-practised patter
With a smile he would frequently drool,
"The pickup in this one is fitted
With a genuine, permanent 'jool.'"

But the stylus felt no such assurance,
When they lowered its face on the disc
And, being of English production,
It said 'Blimey, they're takin' a risk!"

At the end of a month or two's playing,
(Despite what such salesmen allege)
The sapphire's shiny round features,
Gave place to a face like a wedge.

At first the poor, overworked jewel
Tried to skip round the curves as before,
But at last growing weary of trying,
It said "Here's where I even the score!"

So it viciously chewed at the vinyl
And spat little bits out the side,
Till it ruined most all of the records,
That had once been its joy and its pride.

The moral I feel is apparent;
Don't dither and don't play the fool,
Save records and record enjoyment.
DO SOMETHING ABOUT THAT WORN
"JOOL!"

D. O. Ggerel.

Ideally, a stylus should taper at a prescribed angle towards the tip, the tip itself being finished and polished to a definite radius. For 78 r.p.m. records, the tip radius is usually about .0025 inch, .001 inch for microgroove mono and .0007 for microgroove stereo.

These sizes, selected to suit the general geometry of the systems, allow reasonably accurate tracing of the groove, minimise damage thereto and support reasonably well the downward thrust of the pickup. The above statements are qualified deliberately because all these matters are subject to compromise between conflicting factors.

However, as we have been at pains to point out, sapphire styli do wear. The initially rounded tip gradually becomes wedge-shaped, conforming to the grooves in which it rides. In so doing, it becomes progressively less able to follow sharp deviations of groovepath, resulting in a loss of high-frequency response, a rise in distortion level and an increased tendency to disfigure the groove walls as it passes along them.

MONO AND STEREO ALIKE

The rate at which wear occurs is a complex function, depending on the sapphire itself, the downward thrust or weight of the pickup, the mass and compliance of the moving system and so on.

It is generally considered to be even more of a problem with stereo than with mono microgroove, because the tip radius is much smaller and the tracking requirements higher, if the system is not to suffer distortion. Against this, of course, is the fact that most stereo pickups exhibit higher compliance and lower mass than their mono counterparts. The difference may therefore not be as great as would first appear. Sufficient to say that it is a problem with mono and stereo alike.

Some argue that the "life" of a microgroove sapphire

MANUFACTURERS OF STYLI FOR ORIGINAL EQUIPMENT

ALL THESE DEFECTS
CHIPPED, CONE ANGLE TOO WIDE OR BADLY SHAPED RADIUS
CAUSE RECORD WEAR AND BAD REPRODUCTION
AVOID THEM
INSIST ON A GENUINE COLTON REPLACEMENT

COLTON

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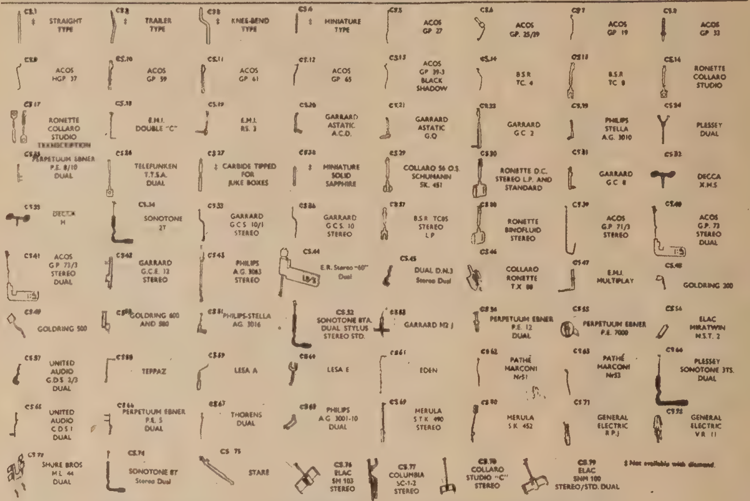
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When ordering, please state clearly type or types required, i.e., 78 r.p.m., Long Playing, or Universal. Where the type is not known or is not readily recognised, please send used sample for accurate identification by us.

MOST TYPES ARE AVAILABLE WITH DIAMONDS

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THE MOST ADVANCED CO-AXIAL DUAL CONCENTRIC SPEAKER FOR HIGH QUALITY REPRODUCTION OF SOUND

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VELCO SOUND SYSTEMS PTY. LTD. 520 BRIDGE ROA
RICHMOND. JB 251

lus is as low as 30 LP sides, if good quality and low ord wear are to be the criteria.

More commonly quoted figures range from 50 to 100 es.

If one assumes that the "average" radiogram owner ys the equivalent of one LP side per day, mono or reo, then a sapphire stylus should be replaced about ry three months.

Now I fully realise how open this statement is. It 't far removed from the idea of a tailor trying to fit rybody out in a line of suits carefully measured to the "average" customer.

Brother, would my legs stick out!

But here's the point: Far better to get everybody into habit of replacing their stylus every three months than now (in so many cases) not at all!

Far better to fit everybody out in an "average" suit n have them running around unclad!

Now then. How long is it since you replaced your lus?

Recently? Good.

But what about the fellow next door?

In the last three or four years, I can well imagine t retailers have had little incentive to worry about worn li. After all, why worry about items at a hundred pence en you can sell TV sets for a hundred pounds or more?

But to judge by remarks lately, a few hundred pence uld be very welcome, particularly if it opened the way a service fee as well.

HAT ABOUT SOME ACTION?

What about it then Mr Retailer? Mr Serviceman? at about making it your business to rectify the situation t so many of you have compounded? Educate your cusners to their own advantage and pick up a bit of business ile you do it.

Initially, it will necessitate a certain amount of selfication as to what the requirements are, what styli suit at pickups and so on. At first it looks quite bewildering, ause styli are such fiddling little things and come in many different shapes and sizes.

Fortunately, servicemen and retailers don't have to rk too much out for themselves, bese the people who distribute these ngs have well illustrated lists available. fact, some of them have been pubed, at various times, in advertisements this magazine.

f you can read, you can be in busis.

ust in passing, one trade house which ame across in Melbourne, is obviously e to the problem. Set up on one ner of their counter is a microscope which anyone can inspect a stylus l decide for themselves whether recement is necessary.

Out of all this comes an obvious stion. Is a sapphire stylus the best wer? Isn't there something that will need such frequent replacement?

The most obvious answer, at the ment, is a diamond. Not so long ago, mond styli were relatively scarce and tly, largely because techniques for ping them as pick-up styli had not n sufficiently developed.

All the time, however, their availability is increasing and the price being shaved, so that, in many cases, it is now more economical to use one diamond stylus than several sapphire.

Diamonds still wear, of course, but much more slowly. Whereas, in the one case, life is reckoned as 50 to 100 sides, in the other manufacturers are prepared to talk in thousands.

By this time, I can imagine certain very astute readers arching their eyebrows and saying "This is a put-up job. This bloke is just out to help the advertisers sell more styli."

ALL IN THIS TOGETHER

Get this straight: If you think that I am in cahoots with advertisers to sell more styli, then you are absolutely correct!

I am.

I want to see more styli sold.

I want to see fewer records "butchered" the first time they are played.

I want to see people get out of them something more like the fidelity of which they are capable.

And talking of records.

How often does one read on the jacket a warning about using worn styli?

There's usually a remark about the R.I.A.A. characteristic, which only the technically minded understand.

There's a warning about playing it with the right kind of pickup, which, for mono at least, most people have.

There's not a word, in most cases, about the one thing on which the public remain so blissfully ignorant.

Well then, Mr Record Manufacturer, what about playing your part with a few well chosen and prominently displayed words?

It's in your own interests to get the best out of discs, particularly with tape getting ready for a new run.

And it wouldn't be a bad idea if our readers, who form the basic core of hi-fi interest in Australia, took it upon themselves to educate the public on this most important point!

APE to DISC

n 45 r.p.m. 5 mins. per side, £1/12/6
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Overall separation is better than—45dB. Playback separation—53dB.

TWO INCOMPARABLE MODELS:—

Type TD extended range, each track same as Ultron 15T.
Type HD extreme range, each track same as Ultron 15HT.

THESE HEADS ARE BUILT TO THE SAME HIGH STANDARDS THAT HAVE MADE L.B. PRODUCTS TAPE HEADS LEADERS IN THE FIELD FOR A DECADE

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Ultron 15, 15T, 15L (Record-play high impedance, extended range. .00016in gap) **£9/13/6**

Ultron 15H, 15HT, 15HL (Medium impedance extreme range. .00016in gap) .. **£9/13/6**

Ultron 15S, 15ST, 15SL (High efficiency record .00025in gap) **£9/13/6**

HE2, HE2T (Record-play, commercial quality .0002in gap) **£6/3/**

EU, EUT, EUL (High efficiency erase) **£5/7/**

H4 (Record-play) and EH4 (Erase) Miniatures .0002in gap **£5/2/**

Note: "T" denotes upper half track, "L" lower half track, all others full track (except H4 and EH4, which are half track).

SEND 4/ Postal Note for a copy of MAGNETIC TAPE HEADS, containing full details of all heads, including Stereo, High Fidelity Circuits, hints to builders, etc. **A FREE COPY WITH EVERY HEAD.** Copies also at Technical Book Co., Swanston Street, Melbourne.

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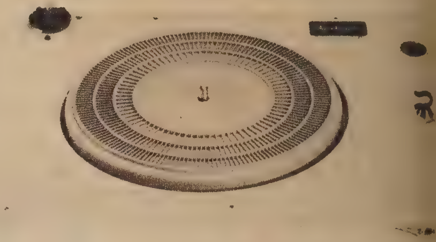
TRADE REVIEWS AND RELEASES

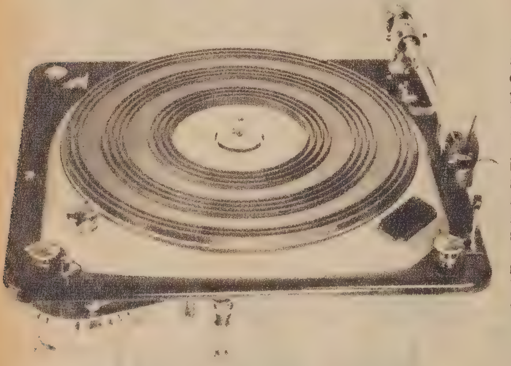
NEW TURNTABLES AVAILABLE FROM G.R.D. INSTRUMENT

Two new turntables, recently announced by G.R.D. Instruments Pty. Ltd., will be of interest both to HiFi enthusiasts and to professional engineers. Both were submitted recently to us for test and appraisal.

THE one pictured on the right is a natural development from the very successful Labcraft 573V record-playing deck, which was reviewed some months ago in these columns. It is a further expression of the maker's claim that, given suitable design, wow-free and rumble-free results can be obtained without resorting to sheer bulk and weight.



At the right is shown the Labcraft 605 turntable, suitable for high quality domestic or professional installations. The Jobo model 2600 is below.



(The makers guarantee wow and flutter at less than 0.15 p.c., with rumble as low as "expensive broadcast studio types.")

The new unit, designated as Labcraft type 605, employs much the same belt drive and speed-change mechanism as the earlier player unit, but important changes have been made to make it more suitable for use with high performance magnetic pick-ups.

A larger base-plate is used, giving space to mount most of the current high-performance arms. The one supplied for review was ready drilled to take the B. and O. or All-Balance arms. the last-named being used for our tests.

A further point of difference is that the whole underneath mechanism has been turned through 180 degrees and, while this puts the speed-change knob toward the back, where it is somewhat less accessible, it does take the motor right away from the arc described by the cartridge.

As a further precaution against hum pick-up by the cartridge, the motor has been enclosed in a large cylindrical shield.

A novel feature is the arm rest, which is so designed that the motor switches on each time the pick-up is withdrawn, and off again when the pick-up is pushed back into the rest.

Still another quite novel feature is a secondary winding on the motor, which provides 15 volts AC, switching on and off with the motor. This voltage is available to operate a transistor preamplifier which the makers have designed and which fits up underneath the motor board. When in use, it accepts the output from a magnetic head and amplifies and compensates the signal so that it can be fed into a main amplifier intended only for a crystal pick-up.

On test, the 605 proved itself capa of extremely good results. Mechan noise is very low and critical listen revealed no evidence of flutter, rum or wow. With the aid of the stro type turntable mat and the varia speed control, exact speeds could readily achieved.

Retail price of the 605 turnta through supply houses throughout A tralia, is £27/7/.

The second turntable (model 2600 a very high quality, fully professio unit manufactured in Holland by Jo makers of the All-Balance arm. W belt drive, in-built strobo lights and p up lowering mechanism, it is one of most ambitious units we have seen. details of price and availability of Jobo turntable, application may be m direct to G.R.D. Instruments Pty. L 6 Railway Walk, Camberwell, Victo

SHURE M7D STEREO CARTRIDGE

PICTURED below is the latest Shure M7D stereo magnetic cartridge, which has been submitted to us for test by "Mastersound," of 400 Kent Street, Sydney.

The cartridge is currently being offered in two forms. It is available with its original N7D stylus assembly, at a retail price of £22/16/.

Alternatively, it can be supplied with the N21D tubular stylus assembly, from Shure's professional cartridge, at a retail price of £34/17/6. This particular combination was highly commended in the American Consumer Report.

Since it is a simple matter to change the stylus, the cheaper version can bought initially and a tubular stylus a ed at a later date.

Under test, the combination of M cartridge and N21D stylus gave a impressive result. Using a stereo recording and an oscilloscope to obse the respective outputs, excellent bala was maintained between the two ch nels and likewise good separation tween them at all frequencies.

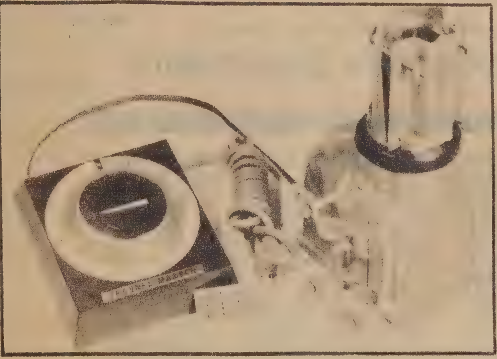
Waveform was notably pure at all quencies, except for a slight deteri tion in the 8 to 9 Kc region. Such effect may or may not be repeated standard music discs and, in any c harmonics from the region fall outs the range of audibility.

The treble response was free of pe up to the 16Kc limit of our te though a small amount of treble bo was needed to maintain the respons level with respect to 1Kc.

Sensitivity to hum pick-up is c mendably low and, in all, the cartri represents an excellent proposition the quality enthusiast. Full details available on request from "Mastersou at the above address.

BEAM ROTATOR AND INDICATOR

Completely new to the Australian market is this beam rotator and compass indicator unit, recently released by Channel Master, Australia. Although primarily designed for TV installations, these units should find ready acceptance by Amateur radio operators, particularly those operating on the VHF bands.



'HREE models are available, one illustrated ng of the "set l forget" fully omatic type.

)peration of the t is simplicity lf. One setting the large con- knob brings beam to the ired direction l an automatic ke locks it in ition. The con- knob's central ɔw indicates the m's actual vement.

lovement of the rotator is accomplish- by means of a small, reversible, two- se electric motor, through a chain precision-machined, heavy-duty gears, ing a reduction ratio of 3,200 to 1. nnection to the control unit is by ans of a three-wire cable, separate n the antenna lead-in.

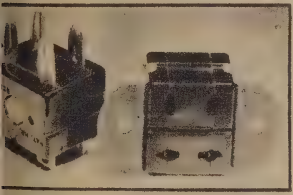
'he rotator unit is completely weather- ofed and lubrication is taken care of a special grease which has a freezing nt of minus 70 degrees Fahrenheit a melting point of plus 370 degrees. 'ower to actuate both the control unit the rotator is taken from the 240- mains through a built-in transform- he actual motor-operating voltage be- 30 volts. This transformer is enclosed he base of the control box, well away n prying hands.

lanufacturer's literature indicated the speed of rotation to be one revolution per minute, but our own tests gave a figure of one revolution per 1¼ minutes. This discrepancy is accounted for by the fact that the units are fully imported and originally designed for 60-cycle operation, as against the 50 cycles which we use in this country.

We have given the unit an actual "on the air" test, using a 10-element long yagi array on 144mc and a three-element yagi on 50mc. During our test, an attempt was made forcibly to stop the rotator while in motion. The result was a joking remark about "a house rotating beneath a stationary beam."

The model illustrated is priced at £39, other models being slightly cheaper. Inquiries should be directed to Channel Master Australia Pty. Ltd., of Pittwater Road, Brookvale. (K.W.J.)

VARICON" CIRCUIT CONNECTORS



CO Australasia Pty. Ltd., a subsidi- ıry of International Resistance Hold- Ltd., have now released in Australia ELCO range of "Varied" connectors, :h are specially adaptable to the needs ›rinted circuits.

aricons are a completely new minia- connector system both in principle application. Basically designed to :pecific requirements, every feature is rect result of an indicated need.

ıe Elco/Varicon principle utilises a nted fork-like contact highly preci- machined, which provides full ng action on four surfaces of 45 ees. They are claimed to provide tive contact under all operating con- ›ns and not to be affected by vibration, repeated insertions and withdrawals or lateral and longitudinal stresses.

The units were designed with primary considerations of mass production applications where quick and easy soldering of wire or solderless connections to contacts would be necessary. Cable clamps provide for positive cable retention and simplicity of installation.

The units are completely flexible from an assembly standpoint. It is possible to assemble, from the standard components, connectors with almost any required number of contacts. Polarity combinations may be varied on individual units with the same number of contacts, so that accidental mating of dissimilar combinations cannot occur.

The photograph shows one of the many combinations which are available within the range and illustrates the type of contact used. The most remarkable feature of these new units is the large number of combinations available capable of meeting many different applications and all accomplished with only four basic parts.

Sales inquiries should be directed to, in Sydney, W. J. McLellan and Co. Pty. Ltd., and Victoria, Australasian Engineering Equipment Co. Pty. Ltd.

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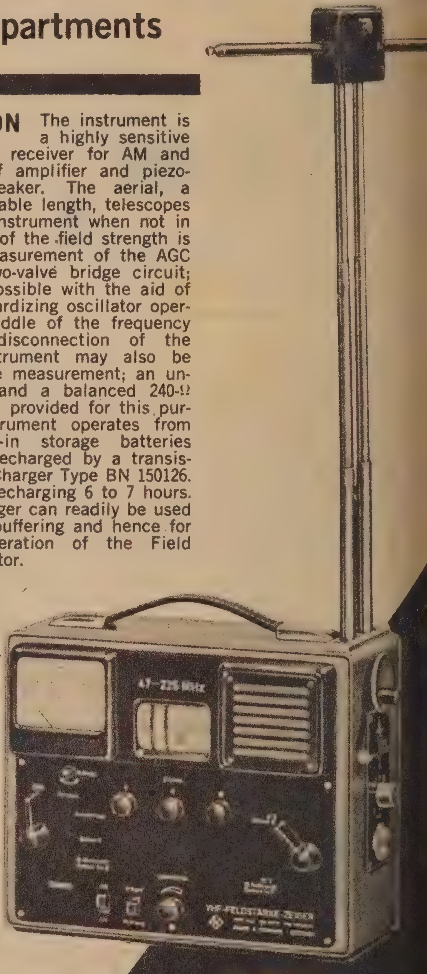
TYPE HUZ· 47 TO 225 M

As used by Government Departments

USES The VHF Field Strength Indicator is a compact test instrument used for surveying the field strength of transmitters in the VHF range. Its uses are many. The propagation conditions of a transmitter, for example, and hence the most favourable site for a transmitter aerial, can be determined. In the case of receiving, and especially television, aerials for which the best site can often only be found by trial and error, a quick and satisfactory result can best be obtained using the Field Strength Indicator. The Type HUZ is also suited for monitoring transmitters, approximate direction finding, and, among other laboratory applications, for detection of interfering oscillators. Connection of a probe permits the testing of interference, for example, in vehicle interference suppression. The wide frequency range of the Field Strength Indicator Type HUZ covers VHF broadcasting, television (Bands I and III), aircraft radio, police radio and speech communication between fixed and mobile stations. Owing to its compactness and light weight, the instrument is easily portable and can be used under even the worst conditions.

DESCRIPTION The instrument is a highly sensitive superheterodyne receiver for AM and FM with an a-f amplifier and piezoelectric loudspeaker. The aerial, a dipole of adjustable length, telescopes down into the instrument when not in use. Indication of the field strength is achieved by measurement of the AGC voltage in a two-valve bridge circuit; calibration is possible with the aid of a built-in standardizing oscillator operating at the middle of the frequency range. After disconnection of the aerial, the instrument may also be used for voltage measurement; an unbalanced 60-Ω and a balanced 240-Ω input have been provided for this purpose. The instrument operates from gas-tight, built-in storage batteries which can be recharged by a transistorized Trickle Charger Type BN 150126. Capacity after recharging 6 to 7 hours. The trickle charger can readily be used for permanent buffering and hence for a-c supply operation of the Field Strength Indicator.

VALVE COMPLEMENT: 1 x DC 70, 2 x DF 96, 6 x DF 906, 1 x DL 96, 1 x 5672, 2 transistors



SPECIFICATIONS

Frequency range, 47 to 225 mc.
Single-range drum dial 1.5 m long. About 8mm on its scale represents 1 mc.
Indication of the VHF input voltage, nearly logarithmic.
Range 1, 1 uv to 1 mv; Range 2, 1 mv to 100 mv.
The readings to be multiplied by a factor k of approx. 1 to 3, according to the frequency.
Range of field strength indication corresponds to the range of voltage indication in uv/m or mv/m.
The readings to be multiplied by a factor k of approx. 1 to 12.
Accuracy — ± 6 db.
Demodulation — for AM and FM, switch-selected.
Measurements of vehicle interferences according to CISRP* recommendations:
Charge time constant — 1 msec, approx.
Discharge time constant — 500 msec, approx.
Overdrive threshold in pulse measurement dependent upon pulse repetition —
  reading of about 1 mv more than 400 cps.
  reading of about 100 uv at 70 cps.
  reading of about 10 uv at 20 cps.
Aerial — tunable dipole, built in.
VHF inputs — a) 60Ω unbalanced, coaxial socket (83-1 R); b) 240Ω balanced, twin-contact connector. (3mm dia., 12mm between contacts).
IF bandwidth — about 100 kc.
Standardizing oscillator — about 105 mc.
Loudspeaker built in, phone sockets provided.
Power supply — from built-in, gas-tight storage batteries.
Charging with Trickle Charger for Type HUZ BN 150126 from a-c power supply — 115/125/220/235 v, 47 to 63 cps (15 va).

Instrument	Dimensions	Weight
VHF Field Strength Indicator Type HUZ	250 x 210 x 120mm	4 kg.
Trickle Charger for Type HUZ	140 x 100 x 96mm	1.6 kg.
Leather Carrying Case for Type HUZ	300 x 300 x 160mm	

PRICE — ex stock including case and trickle charger

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TECHNICAL BOOK REVIEW

JLLARD REFERENCE MANUAL OF TRANSISTOR CIRCUITS. Released in Australia by Mullard-Australia Pty. Ltd., of 35-43 Clarence St, Sydney. Soft Cover, 8½in x 5½in, 308 pages. Contains many circuits and diagrams.

\s the name implies, this book is :nded as a reference of transistor :uitry, for the use of students, service sonnel, technicians and hobbyists. It sists mainly of a brief treatment of design principles of each type of :uit, followed by practical circuits and a.

'he initial chapters deal with the nciples of the junction transistor, and method of curve plotting for the ious parameters. The matter of bias oilisation is then explained, and vari- equivalent circuits given, together h the applications of each.

The main sections of interest in the aainder of the book include Audio plifier stages, Class A output stages, ss B output stages, hearing aids, Pub- Address amplifiers, I.F. amplifiers, io receivers, transmitters, low and h-frequency oscillators (separately), tching and pulse circuitry, and D.C. plifiers and converters.

'hroughout the book, many circuit grams are used to explain points of rest in the text and, wherever practble, suitable component values are :n to enable experimentation to be 'ied out easily. While the book obvily cannot go into the full theory of ay circuits, it usually manages to give icient to enable intelligent progress to made in designing circuits similar to examples given.

'o sum up, a most handy book for workbench or reference shelf, and l worth the 15/ (plus postage) charged it. Our copy came direct from the ve firm, who will supply it to readers :he amount of 16/5 is sent to the lress "Mullard-Australia Pty. Ltd., : 2118, G.P.O., Sydney. (J.R.)"

* * *

IMINATING MAN-MADE INTERFERENCE, by Jack Darr. Soft cover, 5½in x 8½in. 160 pages. Published by Howard W. Sams and Co. Inc. of Indianapolis, New York. Contains photographs, diagrams and circuits.

\s the name suggests, this book is inled as a guide to the detection and ioval of man-made interference. The ses dealt with are not only the comn refrigerator "plops" and "bangs" or uum cleaner hash, but most sources noise and interference in radio and vision receivers.

'hus we find chapters devoted to hash n motors, ignition sparks, fluorescent :s and neon signs, high tension corona television receivers. Interference n amateur transmitters is discussed), in addition to many others. There :ven a section dealing with electric :es.

nitial chapters are used to discuss the ure of man-made noise, its methods generation and possible elimination. ious filter types are dealt with in e detail, and a design is given for a e measuring and detecting meter.

All told, then, it should be a most worthwhile addition to the serviceman's library shelf. Hobbyists and amateurs will also find it useful for those odd jobs entailing removal of suspicious "static" and "snow."

Our copy of the book came direct from the publisher, and no local availability or price structure was supplied. However, it will no doubt be made available here in the near future. (J.R.).

* * *

SERVICING TV TUNERS, by J. E. Dines. Soft Cover, 272 pages, 8½in x 5½in. Published by Howard W. Sams and Co. Inc., of Indianapolis, New York. With photographs, diagrams and circuits.

Intended as a comprehensive guide to TV tuners for would-be servicemen, this book contains a wealth of information on the subject. It should thus be of considerable use both as a reference to servicemen already engaged on tuner service and to newcomers to the field.

The book commences with a discussion from first principles of tuner operation, with a discussion of typical tuner circuits, including UHF types. Chapters are then devoted to tuner components, methods of construction and repair, with an extensive section on troubleshooting in tuner circuitry. Finally, the different alignment techniques are discussed, with hints on response curve analysis.

Many photographs and diagrams are used throughout the book, providing valuable visual explanation of subtle construction and servicing techniques. Although the commercial examples used are all American types, many are identical or at least similar to local types, increasing the value of the book in this country.

No local price is given for the book, which was received direct from the publishers. However, it will no doubt be made available here in due course. (J.R.).

* * *

THE RADIO AMATEUR'S HANDBOOK, 28th edition 1961, published by the American Radio Relay League. Soft cover, 700 pages, 9½ by 6½in.

Here is the latest edition of a book well known to amateurs, radio hobbyists and all those interested in short-wave communication. It has been brought completely up to date by the addition of new material in most of its various sections.

Commencing with a chapter on electrical laws and circuits the book goes on to cover the fundamentals of vacuum tubes, semiconductors, high-frequency receivers and transmitters together with their associated power supplies. This section of the book has long been regarded as a textbook for those contemplating participation in the P.M.G.'s AOCP exams.

Further chapters cover keying and break-in techniques, speech amplifiers and modulators together with the theory of amplitude modulation. Recent years have seen the introduction of chapters on specialised communication systems including single sideband techniques. These chapters have once again been expanded to include much information brought to light by recent development in these fields.

The usual chapters on transmission lines, antennas and wave propagation have been included and contain information on the newer types of "minibeams" becoming increasingly popular in this age of space restrictions.

V.H.F. receivers, transmitters and antennas are covered in later chapters and it is noted that these are becoming increasingly larger as interest in this field of amateur activity increases and techniques become better.

The book concludes with chapters on construction practices, measuring instruments, station operating, vacuum tubes and semiconductor data and the more recently introduced chapters on B.C.I. and T.V.I. A complete index is included at the rear of the book.

One of the most desirable features of this book is the way in which the various chapters are arranged in the same order from one year to the next. One can pick up a copy of almost any vintage and open it with some degree of certainty to the desired chapter.

(Copies from the publishers and from the Technical Book and Magazine Co. Pty. Ltd., 295-299 Swanston St, Melbourne. Australian price 46/6 plus 3/4 post and packing.)

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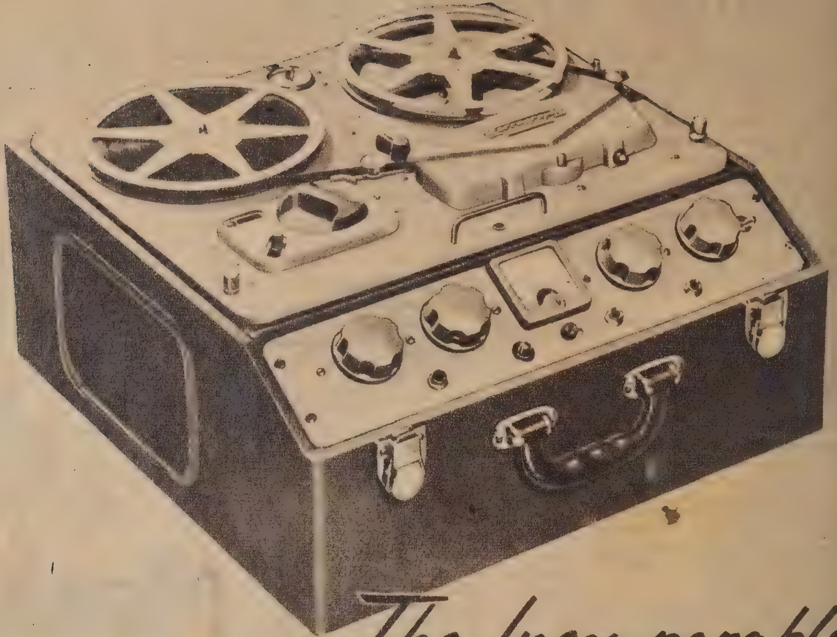

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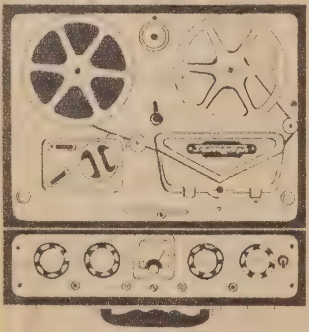

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OFF THE RECORD — NEWS & REVIEWS

ERA OF SELF-PLAYING PIANOS

hen a piano recording by Ignace Jan Paderewski came to hand re- ntly for review, I little expected it to uncover an aspect of musical cording to which I had hitherto given little or no thought. You may not have done so, either.

By Neville Williams

find Paderewski's name on a nodern LP recording could only some process of re-dubbing—the so when the jacket was seen to dorsed "Also available on stereo." efore put the disc on the turntable the same reservations and expecta- as for the many other "collector's" which have been released lately, ining variously engineered copies of hy old cylinders and discs.

remarks on the jacket were some- vague as to the nature of the re- ling, though it was observed that is by no means an ordinary en- ment of old standard 78s." mentioned something about piano " and the fact that the recording een made on "what is perhaps the piano of its type in existence to-

took only a few bars to confirm here was, in fact, something very nt about the particular recording. iano had (or has) a hardness and ght that certainly didn't suggest an ncement of old 78s." Nor, for natter, did the almost complete ab- of background noise.

re was something peculiar, too, the tempo, so I decided to make inquiries.

m the distributors (Festival ds Pty. Ltd.) I learned that the disc ctually a modern recording made high-quality piano specially fitted v piano rolls, as originally record- Paderewski. The electrical quality herefore right up to present-day rds and the mono/stereo alterna- were genuine. That was about as as they knew of the technicalities.

TURED ON SUBJECT

y did refer me, however, to Mr Geeves, program director of radio 2CH, Sydney, who had lectured the Audio Society a couple of ago, on the subject of recording layback pianos.

ranspired that Mr Geeves had got er quite a collection of records, German Telefunken, which had ransferred to disc from piano rolls led by the German Welte Com-

rt from their technical interest, recordings provided a quite inter- commentary, not always flatter- artists and composers of the day. evident, according to Mr Geeves, me of the composers could barely gle through their own works of course, there is no special why they had to!

ably intrigued by the whole thing, all set to start in to some research ese columns when "HiFi Stereo" for March, 1961, turned up on my desk containing, of all things, an article on player pianos by R. A. Leonard. Formerly on the advertising staff of the American Aeolian Company, he had seen at first hand the rise and fall of the Pianola, which was the trade name of his company's product.

The information which follows is a precis of Leonard's article.

One of the first clearly recognisable ancestors of the modern player piano was created in 1863 by Fourneaux of Paris, and was named the "Pianista."

It was a cabinet containing a clockwork mechanism which, when placed in front of a piano and set in motion, pressed down pneumatically on a set of fingers which, in turn, struck the piano keys.

Perforated cardboards, fed into the machine, produced various pieces of music. The Pianista was quite a hit at the Philadelphia exhibition of 1876 and recorded some sales.

PREFERRED METHOD

For the next quarter-century, there was lively debate between all concerned with the development of self-playing pianos. Some insisted on the superiority of player mechanisms of the Fourneaux type; others sought to accommodate the necessary machinery within the case of the piano itself.

Many of the piano makers of the day stoutly resisted the latter development but the public left no doubt as to which type it would buy—the single unit, self-playing piano.

Probably the most successful of these instruments was developed in 1896 by Edwin S. Votey. Though it started out as a separate piano player unit, it later became a combination, that is a piano which could be played by hand or mechanically by means of paper rolls. The machinery inside was operated pneumatically by foot pedals.

A quite significant fact was that the instrument was given one of those fortunate names, which caught on so completely that it was adopted into the language as a noun to describe any self-playing piano. The name: Pianola.

Another significant factor was that Votey had got to know Henry Tremaine, whose father had founded the Aeolian Company.

Tremaine developed into a complete fanatic on the subject of self-playing pianos. With the Aeolian Company holding the patents for Votey's design, Tremaine set out to convince the public that every home needed a Pianola, as part of its cultural heritage.

ASTONISHING SALES

As a result of aggressive advertising and sales techniques, the company sold pianolas in quite astonishing numbers. It absorbed half a dozen smaller concerns in the process and became a manufacturing giant.

The pianola was refined, meanwhile, by Votey and others, to give the player control over "expression."

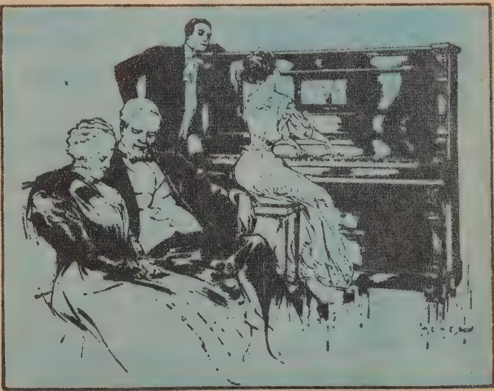
But Tremaine saw in the pianola something more than a honky-tonk device. He felt that it deserved and had to be given cultural status in the field of great music.

He succeeded in convincing Steinway and Sons that the Pianola mechanism should be built into some of their pianos —an arrangement that paid off handsomely for both companies. He erected a huge new building in New York, which accommodated the company's offices, as well as magnificent showrooms and a concert hall.

The next important break-through came when a German manufacturer, Edwin Welte, devised a means whereby player piano rolls could be produced by a person actually playing a piano.

Up to that date, the holes were punched by purely mechanical means in positions to correspond with the musical notation.

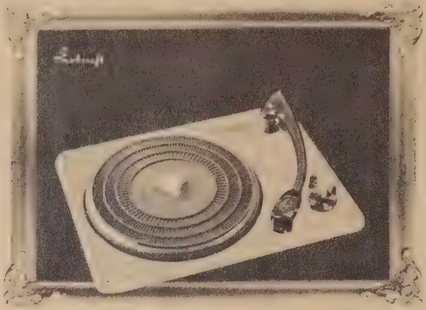
Welte's notion resulted in the creation



This illustration is reproduced from the top of an advertisement for "The Pianola Piano," as manufactured and distributed by the Aeolian Company. In the words of the advertisement "it gives the performer a mastery of the keyboard greater than is possessed by any except a few of the most famous pianists."

WARNING! DON'T ASK THE OLD-TIMER

In his day a House, a Motor car, or a Turntable, just naturally had to be large and heavy to be any good.



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piano with contacts under each of eys, which were wired to a record- achine alongside. As the piano was d, as for a normal performance, g of the contacts caused marks to ade on a paper roll passing through ecording machine.

place of the purely mechanical which had previously been avail- those recorded by these means con- d something of the tempo, rhythm phrasing of the particular artist. was lacking, however, any means ifferentiating between the force which individual chords were k.

DE NOTES

is problem was attacked by having ond musician alongside the artist cord on a score the "dynamics" of erformance. This rough information later transcribed to an extra set of on the roll, operating across appro- holes in the piano's tracker bar.

e best systems, giving wide control the dynamic range, as well as sep- control over melody and accom- ent, were capable of astonishingly e performances.

e Welte Company moved quickly, such equipment, to record short s played by some of the famous ts of the day. They also persuaded osers to record, including Greig, ssy, Saint-Saens, Scriabin, Richard ss, Faure, Gal Glazounov, Leon- lo and Ravel.

rking along similar lines in the an Hall, Tremaine and his associ- introduced their Duo-Art in 1913, in reality a highly developed la. In terminology it had advanced "reproducing piano."

J. Paderewski was signed up to re- exclusively for Aeolian, as also Josef Hofmann, Harold Bauer, ilowitsch, Cortot and many others.

me of the performances were ex- ly lifelike and several Symphony estras, including one under Stokow- were wont to play movements of certo with the pianist's chair empty. is time it was not even necessary ump pedals. An electric motor, ted by a switch, did all the work the pianola—or the Duo Art — played by itself.

ile the bulk of the demand for r rolls involved popular music, a impressive collection of classical s began to build up.

TALOG GREW

the mid-1920s, Paderewski had re- d some 30 works, including one or major ones. Hofmann had pro- an equal number while Stravin- lso made contributions to the list.

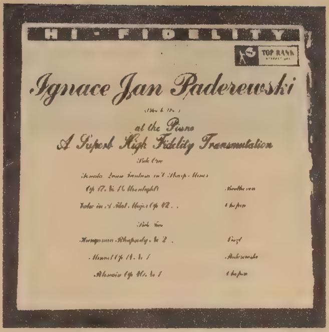
e of the aspects that fascinated rmers of the day—apart from the ding fees—was the fact that mis- could be edited out of the master The "editor" would check the roll y against the score, blank out tape any wrong note and punch ght one in its place!

ecording for player piano was a y compared with the then night- problems of recording for mech- phonographs—to say nothing of ocking audio quality of the latter. 1923 nearly 200,000 player pianos sold in the U.S. alone, while sales lls climbed into the millions.

en right at the height of the boom came a strange contraption which, ironically, was erected on the roof of the Aeolian Hall. It was a radio station, WJZ, which ultimately became the hub of the National Broadcasting Company.

But Tremaine attached no importance to radio till it was too late. Rapidly it diverted attention from the player piano business, leaving the company reeling financially and trying to stem the tide by mergers and various other business manoeuvres. The stockmarket crash of 1929 wrote finis to the whole era.

But though the player piano has disappeared from the world's drawing-rooms, it has left its heritage of people who still have an affection for the old pianola. And it has left a heritage of musical documents in the way of stored and dusty pianola rolls, which can readily enough be transcribed to modern LP records.



The recording by I. J. Paderewski, discussed at length in the columns. Top Rank, Mono TRC-1038; Stereo STRC-608T.

And, after all this, what is my reaction to the recording by I. J. Paderewski?

As I said earlier, electrically, it is quite good. In fact, there is no earthly reason why it should not rank with the best modern piano recordings, though I wouldn't go so far as to say that it does.

Musically, it is a quite different story, and most listeners will be taken aback by the vagaries in tempo and the lack of expression in other respects, despite the claims on the jacket to the contrary.

It is rather difficult to say in what proportions all this should be attributed to the ideas of Paderewski himself, to the difficulties of mechano-pneumatic transcription and to possible shortcomings in the playback for electrical recording.

Sufficient to say that the end result is far too mechanical to be taken seriously in the musical sense. But that does not mean that the record lacks appeal as a collector's item, knowing the whole background.

The contents are: "Moonlight Sonata" (Beethoven), "Valse in A Flat, Op. 42" (Chopin), "Hungarian Rhapsody No. 2" (Liszt), "Minuet, Op. 14 No. 1" (Paderewski) and "Polonaise Op. 40 No. 1" (Chopin).

A Review of Sacred Records

J. S. BACH, "Jesus Dearest Master," "Christ Lay In The Bonds Of Death." The Robert Shaw Chorale, with organ and the RCA Victor Orchestra, cond. by Robert Shaw. Mono. RCA L16272.

The versatility of the Robert Shaw Chorale is indicated by the fact that the last disc reviewed was a collection of love songs—well done but quite trivial. Here, by contrast, they present music which Albert Schweitzer has called "Bach's Sermon on Life and Death."

Typical of the Chorale, the presentation is restrained and sensitive, with organ and orchestra suitably complementing the voices.

By its very nature the music will appeal to a somewhat restricted audience though many, to whom it is unfamiliar, may readily appreciate its deeply devotional quality.

Technically the disc is well recorded.

★ ★ ★

ELVIS PRESLEY, "His Hand In Mine" with the Jordanaires. Stereo, RCA SL 10991.

I've never been a Presley fan, nor was I impressed by his picture on the cover, replete with organ, lace cuffs and choir-boy expression. I found the music inside much more convincing, however.

According to the notes (and who am I to question them) this is music close to the heart of Elvis. No less significant is the fact that he is backed by the Jordanaires, a harmony group of considerable talent.

In all, it adds up to a program of well-executed numbers, ranging from spirituals and hymns-with-a-beat to others notable for their reverence and harmony.

The titles: "His Hand In Mine," "Golden Stairs," "In My Father's House," "Milky White Way," "Known Only To Him," "I Believe In The Man In The Sky," "Joshua Fit De Battle," "Jesus Knows What I Need," "Sweet Chariot," "Mansion Over The Hilltop," "If We Never Meet Again," "Working On The Building."

Technically, the recording is excellent.

★ ★ ★

READINGS FROM THE BIBLE. Charles Laughton. Mono Festival FL-7260.

Charles Laughton is well known for his readings from the classics. On this disc he has recorded four graphic passages from the Bible: "The Garden Of Eden," "The Fiery Furnace," "Noah's Ark," and "David and Goliath."

Though drawn from the Authorised Version, the readings omit some repetitive verses and phrases. They will be missed only if you follow the original but, as a result, the narrative emerges with particular clarity.

Laughton's treatment varies from reading to reading, a notable contrast being the slow, deliberate treatment of "Noah's Ark" and the animated characterisation of "David and Goliath."

Only the individual can decide whether he has a place in his library for a specialised record like this.

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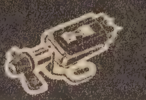

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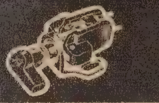

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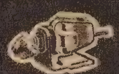

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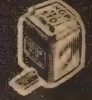

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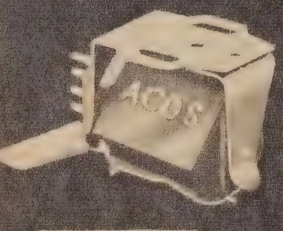

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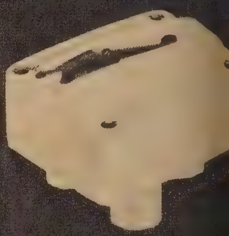

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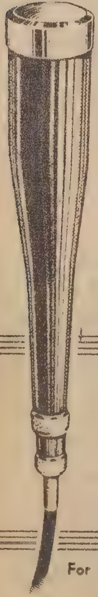

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chnically the recording is of good
lard, though I did notice a faint tape
behind side 1.

★ ★ ★

**HOUSAND TONGUES TO SING.
Music at Moody. Don Hostad and
Robert Carbaugh, Conductors;
Robert Rayfield, Organist; produced
by Paul Mickelson. Mono, Word
W7003/2 L.P. (Gospel Film
Ministry).**

essed in Australia, this two-record
n is supplied in an original American
le-folder, carrying notes on the
c and the groups which perform it.

awn from the thousand students en-
d at the Moody Bible Institute, the
ps include a Chorale, a Women's
Club, Men's Glee Club and
orio Chorus with orchestra. Sup-
ng them is Robert Rayfield at the
nk, 4-manual Moller organ instal-
n the Institute's own auditorium.

might be expected from such a
e, the program has considerable
t, ranging in content from gospel
ns, and a handbell choir to organ
and a performance of the "Hal-
ah Chorus" from Handel's "Mes-
" It is a program which most, in-
ted in church music, will enjoy.

itself, the recording quality is ex-
nt but the critical listener may notice
w surface crackles on the pressing,
the handbell and organ numbers
narred by a background rumble of
description in the auditorium.

owever, these are second-order
isms, offered because it is my job
so. They won't stop you enjoying
nusic.

★ ★ ★

**IC OF THE MENNONITE
CHURCH; The Men's Chorus, First
Mennonite Church, Berne, Indiana.
Directed by Dr Freeman Burk-
halter. Mono, Word W-3078-L.P.
(Distributed by Gospel Film
Ministry).**

e very detailed cover notes explain
the Mennonites are a religious group
orming generally to Protestant prac-
but with strong pacifist views.
have also specialised in unaccom-
ed singing, drawing both on their
music and on traditional hymns.

ese latter include, on this disc, "O
A Thousand Tongues," All Hail
Power," "Songs of Praises" and
rious Things of Thee Are Spoken."
spersed are one negro spiritual and
al Swiss hymns, making up sixteen
s in all.

ly directed by Dr Freeman Burk-
r, the choir of 50 male voices
in perfect ensemble, with not a
of instrumental accompaniment.
ficantly, one does not miss it after
irst few bars.

e recording, technically is right up
andard. In short, male voice sing-
t its best.

★ ★ ★

**SPIRIT MOVES ME. Jack Scott
with the Fabulous Chantones. Mono
Top Rank TRL-8574.**

cording to the cover notes, Jack
is here "singing in spiritual praise
he Lord." Some with traditional
of worship may have reservations
t the statement.

I'm afraid I'm one of them.

But then the same question almost invariably arises when negro spirituals get the modern treatment. As I remarked on another occasion, it's difficult to tell what's negro, what's spiritual and what's pop!

Here a dozen spiritual "hits" are served up with lashings of harmony and percussion.

But, in all fairness, let it be said that Jack Scott and the Chantones do what they are trying to do very well indeed. Teenagers may well vote it "the most."

In terms of quality, surface noise, etc., the disc is above reproach.

IN VARIED MOOD

MR INTERLOCUTOR. The Sound of A Minstrel Show. The Medallion Ministrel Men, Stereo, London SAHA 7543.

Though sold as a "London" recording, the jacket is promimently branded "Medallion — A Product of Kapp Records." "Jacket" by the way, is the wrong term; the disc comes in a stout double-fold album carrying notes about the presentation, the music itself and the method of recording.

Much more than the usual space is given to the technical aspect, which will certainly appeal to R. TV and H. readers. At least eight microphones appear to have been used, many of the stereo effects being enhanced by switching, according to a plan colour-coded on the musical score.

Technically the end result is quite outstanding. From start to finish the sound is clean and sparkling, with plenty of weight and "boomp" in places, and unmarred by the slightest trace of surface noise. A real amplifier show disc.!

The content is also excellent. With just enough of "Mr Interlocutor" to set

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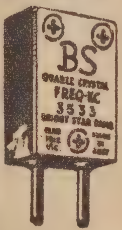

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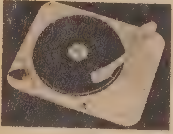

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stage, the emphasis is on "minstrel" c — solo, chorus and orchestra.

doubt that many minstrel shows of 1850's achieved the precision of Medallion Minstrel Men, as here ented, but I wouldn't want it any r way!

★ ★ ★

GHTER UNLIMITED. Mono, Columbia 330SX 7645.

hen I was much younger, there were in humorous 78 r.p.m. records to h I would always stop to listen. r a while I got to know them pretty — as did a good many others of the generation.

ell here they are again, dubbed — extremely well dubbed — on to a e L.P. Remember these? —

Fruity Melodrama" — Only A Mill Girl.

he Scoutmaster" — John Tilley Monologue.

Music Hall Trial Turn" — Horace Kenney.

unning An Office" — Harry Tate and Co.

lay Up And Play The Dame" — Oliver Wakefield.

inderella, Crazy Pantomime" — Flanagan and Allen and Company.

ery one of them is a classic in its right and still as funny as ever. the Australian cover by Emile cier is no less of a classic. It's cier characterisation at its best.

is is one you can't pass up!

★ ★ ★

E MARIE by Rudolph Friml, Herbert Stothart. Lyrics by Otto Harbach, Oscar Hammerstein II. Orchestral Arranger and Conductor, Johnny Douglas; Produced by Cyril Orgadel. Stereo, World Record S. 7014.

nings seem to have got off the track this disc. Of two copies I viewed, with stereo labels came in a mono et; the second was marked stereo in places but the numbers differed — ono number on the jacket stereo on label.

ne quality, too, will disappoint hi-fi usiasts. With good sound and wide onse in the less onerous sections, it ks up noticeably as the level mounts ontrary to what I have come to ex- of World's musical comedy discs.

s a pity because the cast, including Linden Singers, turn in what could n enjoyable performance of a show has been an established favourite 1924.

★ ★ ★

OLLING VIOLINS, Frank York and His Orchestra. Mono, Coral CL-7655.

ccording to the jacket the word olling" means here exactly what it , Frank York and his strolling violins g featured regularly at the "Hotel rman's College Inn Porterhouse' in cago.

ed by Frank York, and supported by occasional touch of percussion, the l, predominantly string orchestra ents a variety of tuneful favourites nently suitable as a background to ng — or just plain listening.

mong the titles are (my abbreviations) "Sorrento," "Intermezzo," "Wunderbar," "Fascination" and "Ole Smokey" — adding up to some sixteen in all.

The quality from start to finish is consistently good.

★ ★ ★

SOMEDAY I'LL FIND YOU, Victor Sylvester and His Silver Strings Play the music of Noel Coward. Stereo Columbia SCX0 3329.

Victor Sylvester and his orchestra could hardly miss — and he certainly doesn't — with this collection of ever-popular Noel Coward melodies. The titles are selected to represent the period from Coward's early "Parisian Pierrot" (1923) through the "Bitter Sweet" (1929) era, to "Ace of Clubs" (1950).

It's good listening but, if you prefer to dance, you get quicksteps, slow foxtrots and waltz in the strict tempo, Sylvester fashion.

The recording quality generally is excellent except for some slight deterioration on the inner track on side 1. The difference probably won't show up on normal "grams" but hi-fi enthusiasts would probably notice it.

A very pleasant disc, all the same.

★ ★ ★

VERA'S GREAT CHORUS HITS. Vera Lynn And Chorus. Mono, Ace of Clubs ACLA 1045.

In an atmosphere bordering on community singing, Vera Lynn sings a dozen numbers as under:

"Travellin' House," "When Swallows Say Goodbye," "Windsor Waltz" "Forget Me Not," "Gathering of the Clans," "Auf Wiedersehen," "Yours," "Doonaree," "Humming Waltz," "When You Hear Big Ben," "From The Time You Say Goodbye" and "We'll Meet Again."

In most of the numbers she is backed by the Roland Shaw Orchestra with Chorus or (I quote) "members of H.M. Forces." The presentation is pleasant enough but lacking in variety.

Unfortunately, I can't rave about the quality of the recording. The orchestra too often sounds remote, while distortion on peaks mars the massed voices. Just so-so!

★ ★ ★

LIBERACE At The London Palladium, with the London Palladium Orchestra. Stereo, Coral CRL 757346.

Recorded about 12 months ago, at the opening of a new season at the Palladium, this is Liberace in large dosage: His facile, if highly embellished display at the keyboard, the orchestra at his beck and call, "gallery" patter, references to "mother" and remarks that, but for their publicity angle, would far better have been left unsaid.

If you're a Liberace fan, you'll probably love it. It you're not, it will provide material for a still bigger and better hate session. Either way, Liberace professedly doesn't care, provided you buy the record.

The contents: "Rhapsody In Blue," "I Got Rhythm," "Mack The Knife," "Tico Tico," "Me And My Shadow," "Paris Selection," "Jealousy," "Boogie Woogie," "You Made Me Love You" and, of course, "I'll Be Seeing You."

Recording quality? Good.

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IN REVIEW—By JULIAN RUSSEL

ISAAC STERN—Best Stereo Version

Beethoven—Violin Concerto in D Major, Op. 61. Isaac Stern and the New York Philharmonic Orchestra conducted by Leonard Bernstein. Coronet Stereo KLCS2719.

This is the best stereo performance of the concerto to date, and one which I can recommend with the greatest enthusiasm.

Stern maintains throughout a magnificent grasp of the work's architecture, thinking each movement through logically to its last bar, untempted to detour in order to display his virtuoso skill.

He even presents the cadenzas with an assurance that minimises, to the listener unaware of the technical problems involved, the vast technical resources required to deliver them in this manner. His tone is always excitingly taut and vital and reflects constantly the quality of the fastidious musical intelligence by which it is controlled.

Stern's success is helped by two important contributions—Bernstein's exemplary accompaniment and Coronet's sound engineer's superb recording. Bernstein sometimes tends to offer highly personal accounts of what he plays, but here he is the perfect partner, retiring selflessly into the background whenever necessary and asserting himself only when the composer has a more forceful expression in mind.

The balance is consistently excellent. Stern, placed immovably between the two speakers, is just far enough in from the orchestra to produce the sort of effect which might be heard in a concert hall blessed with admirable acoustics.

Not a note of his is lost, yet despite the clarity, there is never a hint of bow scrape or fingerboard thump.

And the orchestra has been similarly served. The tone is luminous and transparent, polyphony, when it occurs, beautifully stranded, and the wide dynamic range adjusted to comfortable listening in an average sized room.

* * *

Tchaikowsky—Violin Concerto in D Major, Op. 35. Mendelssohn—Concerto in E Minor, Op. 64. Isaac Stern and the Philadelphia Orchestra conducted by Eugene Ormandy. Coronet Mono KLC2703.

Stern offers here what might perhaps be described as a "classical" account of the extremely non-classical Tchaikowsky. By that I mean that he never allows the composer's romantic extravagances to become perfervid, contenting himself with a warm but never rhetorical reading.

And again his dazzling technique overcomes every problem with almost casual ease.

Indeed one can enjoy the sheer technical wizardry of the performance to an extent that over-rides any other considerations.

Those, however, who like their Tchaikowsky red hot might find Stern's a rather too studied realisation of the concerto's potentialities.

I could find only one place where Stern seems momentarily uncertain of where he is going — in the otherwise superbly played Finale, articulated at a speed that must be heard to be believed.

Ormandy deploys an Aladdin's cave of orchestral riches, though once or twice he overshadows the soloist. But this is a mono disc, and though, indubitably well engineered, might alter what could be a perfect balance in a stereo version.

Stern's beautifully pure, unexaggerated style is admirably suited to the Mendelssohn. His performance has all the fire anyone could desire, yet the composer's exquisite proportions are always respected. You may prefer slightly more demonstrative interpretations of these two concertos, in which case I suggest you compare Stern's in the Tchaikowsky to either Oistrakh's or Ferras', and in the Mendelssohn to Ferras' again.

A very slight surface prickle occasionally intrudes during the quietest bars of my pressing.

* * *

Mozart—Violin Concertos No. 3 in G Major (K.216) and No. 4 in D Major (K.218). Zino Francescatti and the Columbia Symphony Orchestra conducted by Bruno Walter. Coronet Stereo KLCS2698, Mono KLC2698.

In the stereo the soloist veers a little toward the right-hand speaker if proper orchestral balance is established. But he is nicely free of the accompaniment and stands out in just the right proportion. In the mono, of course, he remains in the middle when played on two-channel equipment, and though this is extremely well recorded (for mono), some little loss of orchestral transparency can be noticed when it is compared with the stereo.

Perhaps it is the monitoring that makes Walter's orchestra sound rather larger in the tuttis than one might have expected from him in these Mo
pieces. At any rate, the effect is
the tiniest bit solid though it retires i
perfect perspective whenever the sol
enters. And Walter's Mozart style is,
course, impeccable.

Technically, Francescatti leaves nc
ing to be desired. Interpretatively, th
are eminently graceful performances,
livered in the sweetest possible tone w
plenty of rubato. They are never
than appealing. Grumiaux' recording
Philips, released some years ago
since deleted from their catalogue,
a broader approach.

A comparison of the first movem
of the G Major played by both art
reveals Grumiaux' tempo to be nea
half the speed of Francescatti's, wh
phrasing sounds almost breathless alo
side the Belgian's. And Coronet's m
recent engineering is a good deal ah
of Philips', though the latter can be
scribed as better than serviceable.

However, the Philips is no lon
available unless you can pick up an
one from a dealer's shelf, and in
meantime the Coronet should do nic

There is, on the Coronet, a trace
fingerboard thump in the first cade
of the D Major.

* * *

**Mozart—Piano Concerto No. 20 in
Minor (K.466). Piano Concerto
23 in A Major (K.488). An
Fischer with the Philharmonia
chestra conducted by Sir Adr
Boult. Columbia Stereo SAX23**

In my review of this disc for the S
ney "Sun" I pointed out the welc
tendency in recent recordings to pl
the first and second violins to the
and right of the conductor respectiv
thus giving more point to conversatio
or, more professionally, antiphonal
sages between the two groups.

This was for many years the us
way to seat an orchestra in a con
hall and has only been altered du
the last generation or so. With sco
is luminous as Mozart's, the "n
seating arrangement adds much to
listener's enjoyment, especially in th
passages where the soloist is tempor
ly silent. There are bars in the D M
when, despite an excellent stereo spr
the soloist disappears momentarily
hind the accompaniment, but they d
occur frequently enough to cause m
damage.

And Madam Fischer's playing of th
two works is always so warmly hu
and free of "tick-tocking" that they
easily be excused, however irrita
they may be at the time. I hasten to
that Madam Fischer never sentime
lises the music, nor increases the
namic range beyond the bounds of fa
less taste.

Purists may complain that here
there in the A Major the soloist
too little attention to the composer's
pressed instructions, but again no d
age is suffered in the process. I fo
the tiny pauses in the Romanze of
D Minor a much more significant de
ture from the eighteenth-century s
And while I am quibbling, I might n
tion that the Philharmonia, though g

t always quite up to its very best ard.

d I write "quibbling" with truth, ise the general effect of both perances is rewarding indeed, if you be generous enough to overlook the s mentioned earlier. And I shall ys be grateful to the bassoon player in the Finale of the A Major, gives a beguilingly jovial account of his

* * *

ak — Slavonic Rhapsody No. 3 Scherzo Capriccioso. Brahms — Hungarian Dances Nos. 1, 3, 5, 6, 17, 18, 19, 20 and 21. Royal Philharmonic Orchestra conducted by Rafael Kubelik. H.M.V. Stereo ASD347.

is fashionable nowadays to refer to Third Slavonic Rhapsody as a bit of re, though just why such an artless, etentious bit of music-making should that reputation has always puzzled writer. To him it is eminently pleasis a piece of purely light entertain, and fits in well with the record's contents which are designed to al to those who like their music and tuneful.

e sound is first rate, improved on set by the slightest possible bass t, but that may not be necessary on s. I have only one serious criticism ake about Kubelik's performances, use of rubato that gives the impres of being applied rather than growout of the natural structure of the cal phrase.

dmittedly rubatos have their rightplace in this music, but I would have yed them more here had they seem trifle less studied in their applic. But I concede that apart from mild tempo changes the rest of the is presented with such grand elan rhythmic ebullience that they seem st trivial in retrospect.

e orchestra's tone is rich and full, a brilliant edge on it when neces, and always voiced with impressive racy. A pianissimo just before the at the end of the Capriccio is as essive as anything I've heard for a time.

* * *

a—Suites Nos. 1 and 2 from The Three Cornered Hat. Ravel—Suite No. 2 from Daphnis and Chloe. Alborado del Gracioso. Philharmonia Orchestra conducted by Carlo Mario Giulini. Columbia Stereo SAX2341.

he two Falla suites contain much e of the ballet than you usually find selections." Indeed, little that is imant has been omitted. This music ands great rhythmic vitality for essful performance, and receives a measure throughout Giulini's divertreading.

his buoyancy is never sacrificed, ever forceful a climax may present f to be surmounted. For Giulini does consider climaxes and accelerandos parable, as do some other conors, and builds up impressive inses of tone and tension without any of fever.

know of no other recorded perform of the Alborado that offers such cious clarity of articulation and detail out degenerating into an X-ray nination of the score. The balance n only describe as miraculous, and meaning of Gracioso is never foren by either the conductor or his responsive orchestra. This is dandy's music, presented with all a dandy's exquisite polish.

Exquisite, too, is the only word I can think of to describe the enchanting flute solo in Daphnis and Chloe, and I doubt if any other conductor has found so much beauty in the rustlings and chirpings of the opening bars, nor more tenderly voluptuous happenings in the strings.

Those used to enjoying The Three Cornered Hat as a ballet may find some of Giulini's tempos a trifle on the slow side. But this is a concert performance, in which no consideration for dancers is necessary, and once you get used to the new speeds, I feel sure that you will find the same great pleasure in this exciting disc as I did.

* * *

Spain — Granados: Intermezzo from Goyescas; Falla:—Intermezzo and Dance from La Vida Breve; Dances from The Three Cornered Hat; Albeniz:—Navarra; Fete-Dieu a Seville; Triana. Chicago Symphony Orchestra conducted by Fritz Reiner. (RCA Stereo SL16269.)

The Three Cornered Hat is much abridged in the version offered here, but what remains comes off with superb glitter and rhythmic force. Reiner has, over the years, built up the Chicago into one of the most impressive units recording today, and this entire disc is an admirable example of this fine orchestra at its best.

The outstandingly rich tone is beautifully balanced between the speakers, and the picturesque scoring provides both the players and the sound engineer with many opportunities to delight listeners with their skill. Neither the passionate opening of the Vida Breve Intermezzo nor the essentially graceful following dance are presented at the expense of the sensuous character of the music.

I can imagine no more enjoyable introduction to Spanish music of the lighter type than you will find here.

* * *

Wagner—The Mastersingers Overture. The Flying Dutchman Overture. Prelude and Good Friday Music from Parsifal. The Columbia Symphony Orchestra conducted by Bruno Walter. Coronet Mono KLC2737.

Wagner—Tannhauser Overture, Ride of the Valkyries (Die Walkure). Prelude to Act 1 (Lohengrin). Prelude and Liebestod (Tristan und Isolde). Funeral March (Gotterdammerung). Orchestra du Theatre National de l'Opera (Paris) conducted by Pierre Dervaux. H.M.V. Concert Classic, Mono OXLP20011.

Walter first won fame with his conducting of Wagner at the outset of his career and has never faltered in his love of that composer, despite Wagner's temporary decline in public appreciation during recent years. And he lavishes all his old affection on the excerpts presented here.

I enjoyed most of his fervently devout playing of the Parsifal items, the Prelude as tranquilly aspiring as a Gothic cathedral, the Good Friday Music sensitively alive to all the pious nostalgia Wagner expresses so eloquently. If you have been "put off" Parsifal by musicians who claim that the composer's inspiration had deserted him in his old

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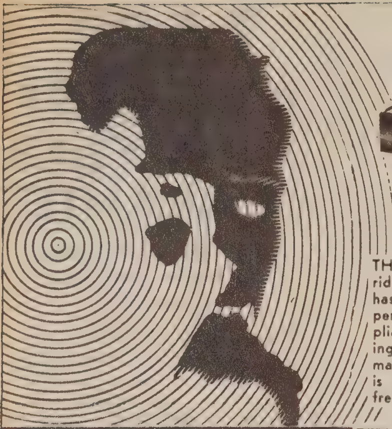

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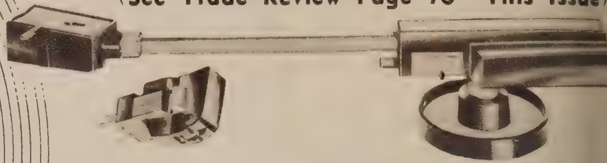

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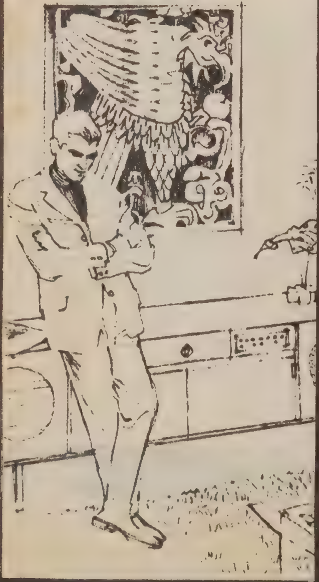

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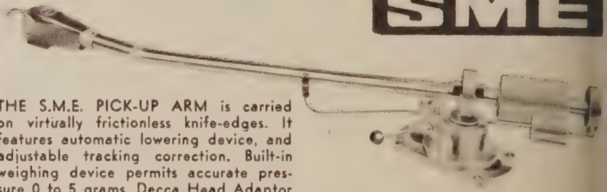

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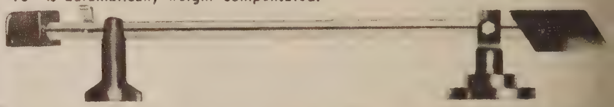

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play these two excerpts and see you think of him yourself. I t if you will hear better perform- for many years to come.

comparison, the Flying Dutchman ture will sound very simple in both and content, but it still wears ex- ely well. It relies a great deal for ssful performance on the skill of brass players, and the cor anglais is given the Senta theme to de- after the turmoil of the first state- of the Dutchman's theme has sub- . Walter's musicians serve him ad- bly here.

me slight overbalancing of the rest e orchestra by the woodwind just e the final climax might be adjust- a stereo version if one should ever sued. But otherwise this is a fine ng performance of an early work gives ample proof of the genius of young composer who wrote it.

e Mastersingers Overture, different in temper from the rest of the has about it a grand solidity that ures all the pride of the worthy hers it depicts, and varies this mood the more tender passages taken the opera. Altogether a splendid nerian concert.

ere is a very slight prickle on both of my pressing.

e Dervaux disc, too, has much to mmend it, particularly its price, these Concert Classics sell for 39/6. Dervaux is no Walter, but isses little that is relevant to an effi- performance of all he offers here.

would have liked a little more aban- in some parts of the Tannhauser ture which, despite some luscious g tone sometimes becomes a little . And the Lohengrin Prelude is r quite air-borne either at the begin- or end, though the middle climax plenty of authority.

he climaxes of both the Tristan items ld have been more effective had the pets been placed where their con- tion might have carried more ht, and the strings, rushing upwards rds the orgasm of the Prelude, fice thrust for speed. The Ride of Valkyries, taken steadily but not -cautiously, and Siegfried's Funeral ch, are both excellent, and at its low this would make a good investment those to whom Wagner's music is an experience to be enjoyed.

* * *

uss (Richard)—Don Quixote (Fantastic Variations on a Knightly Theme) Op. 35; Till Eulenspiegl's Merry Pranks, Op. 29. Berlin Philharmonic Orchestra conducted by Rudolf Kempe. World Record Club Stereo STE243. Mono TE243.

recommend this as another outstand- bargain at 39/6. First I should like tate that the orchestral playing is r less than superb, and that the cello part, which has almost the ensions of a concerto, is most elo- tly delivered by Paul Tortellier. The ed violin solo in the introduction es as delicately as a mosquito, then gives way to the wonderfully confused passages that express the poor old knight's approaching madness. If ever insanity was depicted in music, it is in these inspired bars which lead to a climax in which you can almost hear the old man's consciousness snap.

The work is full of such graphic illustrations. Some of the incidents you should recognise immediately — Don Quixote's tilting at the windmills, his flight through the air, and the flock of sheep he mistakes for a hostile army. The last, by the way, is the only short passage to disappoint me, for slightly too careful articulation makes the sound too reminiscent of an orchestra imitating a flock of sheep instead of the real thing that can be brought off with astonishing realism if properly played.

In addition to all this picturesque evocation of events in the Cervantes story, Strauss was also able to build up "in-the-round" portraits of the two chief characters. You will hear the Old Don's extravagant claims for chivalry quietly, firmly, and oh so sanely rebutted by his faithful servant Sancho Panza. It would require very little imagination to supply words to the long conversations that take place between the two.

Excellent annotations on the sleeve will supply all the clues you need to follow Don Quixote's adventures, but I must warn that once-through will not be enough to appreciate all that Strauss has set down in this wonderful score. But I can promise you that each time you repeat it you will find something else to marvel at and enjoy, both in the writing and playing.

I also urge you not to go on immediately to Till Eulenspiegl after listening to Don Quixote. Till is rare fun, but it is quite outclassed by the longer work. It receives here an admirable performance, too, just about the finest available.

* * *

Sibelius—Symphony No. 5 in E Flat. Symphonic Fantasy, Pohjola's Daughter. B.B.C. Symphony Orchestra conducted by Sir Malcolm Sargent. H.M.V. Stereo OASD303.

There are two ways of interpreting Sibelius' music, especially his symphonies. One is to depict a landscape of chilly grandeur devoid of any living creature, the other is to relent and infuse humanity into the bleak splendour. Sargent uses the second approach, in this performance with considerable success.

A feature of the splendid stereo sound is the bright edge on the composer's wonderfully solid writing for brass, and the restricting of the woodwind to within limits that might be duplicated in a concert hall. I mean by this that the players are not perched on the listeners' shoulder, where he sometimes finds them in some present-day recordings.

Despite his humanistic reading Sargent retains the symphony's statuesque proportions and pushes the Finale along to a most impressive close. Ponjola's Daughter, a symphonic poem based on an ancient Finnish legend, makes a first class fill for the second side.

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A full size sensitive switchboard meter movement is built into the instrument, thus providing an unusually large scale, making easier reading and more accurate measurements. The large 8-inch meter face is effectively and beautifully illuminated from the rear and the two colour scale has clear graduations and easy-to-read figures.

Model TVR/EV operates from 240 volts A.C. mains and is supplied with instruction booklet, circuit diagram, D.C. voltage probe with inbuilt isolating resistor, A.C. voltage probe, ohms probe and earth lead. Available accessories are a 30,000 volt D.C. probe, a radio frequency crystal probe up to 50 volts at 250 m.c., and a valve probe enabling radio frequency voltages to be read up to 300 volts at 250 m.c.

Truly this is a remarkable instrument, packed into the small size of 10 in. x 6½ in. x 5½ in. You are invited to write for further details.

RANGES:—

D.C. Volts Negative: 1-3-10-30-100-300-1000.

D.C. Volts Positive: 1-3-10-30-100-300-1000 and wi external high voltage probe to 30Kv.

A.C. Volts: 1-3-10-30-100-300-1000.

Peak to Peak A.C. Volts: 2.8-8.4-28-84-280-840-2800.

Ohms: 0-1000, 0-10,000, 0-100,000, 0-1 Meg, 0-10 Me 0-100 Meg, 0-1000 Meg.

RF Volts: 1-3-10-30 (with crystal probe).

RF Volts: 1-3-10-30-100-300 (with valve probe).

D.B. Ranges: — 20 to + 2, + 2 to + 22, + 22 to + 4 + 42 to + 62 (0db = 1 m.w. in 600 ohms).

Also Centre Zero D.C. Ranges for discriminat alignment.

Accessories available as extras:—

30Kv D.C. probe — Crystal RF probe — Valve dio RF probe.

UNIVERSITY GRAHAM
INSTRUMENTS PTY. LTD.

5 North York Street, Sydney—BU 3169

University Graham Instruments Pty. Ltd.,
5 North York Street, Sydney.

Please mail me details of Model TVR/EV.

Name ....

Address ....

....

16/F

AMATEUR BANDS WITH BILL MOORE

.W. LISTENERS ARE IMPORTANT

hort Wave Listeners, or SWL's as they are better known, are just
ardent radio enthusiasts as their fellow amateurs. When they are
ot listening to International Short Wave Stations they spend their
ours combing the amateur bands for the unusual signal.

DRT Wave Listeners form an im-
ortant section of the amateur move-
and it is from this section that
najority of radio amateurs are en-
. In the days before readily avail-
AOCP classes, oral or correspon-
, 90% or more of new amateurs
heir first introduction to the hobby
heir short wave sets. It was gener-
some individual amateur who pro-
the tuition and introduction to
ransmitting side, besides providing
e practice.

JORITY SOURCE

these days perhaps not so great a
ntage of new licensees are drawn
the SWL ranks but the majority
s from this source. With a back-
nd of S/W listening they are cer-
better equipped to commence
tion on the amateur bands.

e SWL often spends as much time
is equipment as many amateurs,
ing either on the SW B/c or
eur bands. They are just as keen to
new country as amateurs are to
ct one. They like too to receive
cards in return for their reports.
are encouraged by the courtesy
reply and amateurs should remem-
heir SWL-ing days and return the
liment.

recent years the WIA through the
us State Divisions have organised
groups and run their own page in
teur Radio. Some idea of the high
e of activity among these en-
asts can be obtained from their
ladder showing countries heard and
rmations received. The leader on
ladder must be Eric Trebilcock,
n as BERS195 to amateurs
ghout the world, who recently sub-
ed for Ray Jones, VK3RJ,
ral QSL officer, during his over-
trip, Eric, in the last list, had heard
countries and has 261 confirmed.
de Balfour is in second place with
heard and 122 confirmed and C.
pe third, 137 heard and 85 con-
ed.

FICIAL NUMBERS

e WIA provides them with official
bers listed in the Australian Call
, the facilities of their QSL
au, etc. Listeners who are interested
neeting other SWL's, participating
ontests, acquiring disposals gear,
ld join the Section in their State.
iiries should be directed through the
Secretary of the State in which
reside at the addresses listed from
to time.

he N.S.W. Division's SWL section
their annual elections in April, and
following officers were elected for the
ing year:— President Alan Chatto,
35; Senior Vice President Barney
Smythe, L2001; Junior V.P. Peter Harding, L2187; Secretary Doug Allen, L2215; Council Liaison and QSL officer Barney Smythe; Dural 2WI Representatives Joe Pollock, L2156; Phil Irvine L2155.

The Secretary Doug Allen can be contacted at his home address, 375 Bathurst Rd., Springwood, or at Sydney, phone number MX4041 during business hours for inquiries re membership or for information.

The section meets on the 3rd Friday of each month at Administration H.Q., Atcheson St., Crow's Nest. As a new project, and one that could be of great value to SWL and amateurs alike, they have commenced the reproduction of Service Manuals for receivers. Work on the AR7 manual is complete and it is intended to cover the 522, R1155, 122, AR8, AMR101, 19, and AMR300, in future publications. These manuals will be available to all WIA members at a cost to be fixed.

MOON BOUNCE

MANY amateurs, mainly professionally qualified engineers, have been expressing opinions on the prospects of amateur moon-bounce and satellite-bounce amateur operation. Opinions vary quite an amount but generally the U.K. enthusiasts favour the prospects of a satellite-bounce while in the U.S. moon-bounce operation is given the highest priority.

In either case, as has been proved, such operation is not for individual amateurs, finance, time, etc., precluding such a venture. It is more a job for a club project, supported somewhere along the lines by some commercial organisations. Perhaps the most comprehensive appraisement of "Bouncing" working is provided by Dr Robert Beam, W9BGZ, in a Hallicrafters advertisement, the details of which are listed below.

The satellite Echo was launched in a circular orbit at a radius of approximately 5,000 miles. Echo has a diameter of about 100 feet and subtends an angle in the order of 1/100th of a degree when viewed from the earth. It travels at a speed of about 16,000 miles per hour and makes a revolution in less than two hours.

It is visible for periods of around 15 minutes per revolution. The high speed and small subtended angle make tracking of Echo quite difficult. The high speed also causes a maximum Doppler shift in the large frequency order of 0.1 mc/s for a 2400 mc/s carrier signal. The time required for a radio signal

(Continued on Page 97)

"POLICING" THE AMATEUR BANDS

AMATEURS by their own efforts in many countries provide the organisation for the policing of their own frequencies to ensure that the standard of signals and operating is maintained. Very similar systems operate in the U.S. and in Australia where active amateurs monitor the bands and provide reports on signals that are not of the accepted standard. Subsequently the amateur concerned receives a reminder of his misdemeanour termed a "Pink Ticket," in the U.S. and generally a "Blue Ticket" here in VK.

The appropriate governmental authority, of course, also provides their own monitoring system for all radio services and covers, in normal course, signals from amateurs. The U.S. amateur self-policing scheme has been in operation for 35 years while, in Australia, it has been running for nearly 25 years. The only difference between the two arrangements is that, in the U.S., the official observers form the ARRL's Co-operative Monitoring Service with no official connection with the FCC. However the scheme is fully supported and appreciated by the commission.

In Australia the Advisory Committee is set up by the P.M.G.'s Department but contains WIA nominees. The ARRL's OO's sent out over 20,000 cards during 1960 to amateurs whose signals or operating were not just up to standard. Most were for minor technical discrepancies. These reports provide the operators with an opportunity to rectify faults before they come to official notice.

The Australian Amateur Advisory Committees are well known and amateurs generally appreciate their work as a serious endeavour to clean up signals on amateur bands.

They are organised in each State under the chairmanship of an officer of the P.M.G.'s Department with the sole object of ensuring the best operating conditions prevail on the amateur bands. In some circumstances they issue a notification requesting any amateur who breaches a regulation or whose transmission is below standard to indicate what steps he has taken to prevent a re-occurence of the trouble.

Self-policing of the amateur bands is a work of value to the amateur service in ensuring better operating conditions. Amateurs who conduct these duties could enjoy themselves in pleasurable contacts or other activities instead of searching for key clicks, bad notes, etc. The volunteering of their time on these duties is a valuable contribution to the service. By performing these chores they are often in an unenviable position but they can rest assured the average amateur really appreciates their efforts and supports their activity.

WARBURTON FRANKI

- AUSTRALIA'S BIGGEST RANGE AND BEST VALUE IN RADIO PARTS

KEW MULTIMETER TK70B

Sensitivity—D.C. 20,000 ohms. volt. A.C. 9,000 ohms. volt.

Volts—A.C./D.C. 0-10, 0-50, 0-250, 0-500, 0-1,000.

Milli-amps D.C.—0-500 u.a. 0-10 m.a. 0-250 m.a.

Resistance—0-20K ohm. 0-200K ohm. 0-2 megohm. D.B. (up to 6,000 cycles) to 22 D.B.

Capacitance—.001 to .2 mfd. Size 5⅛in x 3½in x 1⅝in.

Price—£7/12/ plus 12½% Sales Tax.

SUPPLIED COMPLETE WITH INSTRUCTION SHEET AND TEST LEADS

* * *

SCOPE—Low Voltage Soldering Iron. Safe and convenient to use. Iron only —£2/15/. Pack and Post 5/. Transformer to suit—£2/15/. Pack and post 5/. Will also work from Car Battery. A complete range of spares always in stock.

PRONTO SOLDERING GUN—complete with in-built transformer —£6/10/. Pack and post 5/. Automatic Solder Feed Attachment—**26/8.** Pack and post free.

SUPERIOR SOLDERING IRONS, 240V.

S4, 25 Watts .. **49/6**
A1, 40 Watts .. **35/** Pack and
S1, 55 Watts .. **45/**
A2, 60 Watts .. **42/6** Post 2/6
A4, 80 Watts .. **52/6**

SOLDER—36in lengths. Resin Cored Ersin—**1/ each.** Pack and post free.
1lb Reels 40/60 **12/3 ea.** Pack and
1lb Reels 60/40 **14/8 ea.** Post 1/3

DIAMOND STYLI Standard 78. No. 7, 8, 14, 16, 17 and 24. **19/11 each.** Pack and post free.

METERS—4in Square.
0-1 m.a. Plain Scale .. .. **75/** each
0-1 m.a. Multimeter Scale **75/** each
0-500 u.a. Plain Scale .. **79/6** each
0-50 u.a. Plain Scale .. .. **87/6** each
Pack and post 2/6 ea.

POWER DIODES—Similar to OA210, IN1763, etc. Type HR25—**12/3 each.** Pack and post free.

1H6G 2 VOLT DIODE—TRIODES— 2/11 each. Pack and post 7d.

FRAME OUTPUT TRANSFORMERS—Suit 6BM8 Valves—**29/11.** Pack and post 2/1.

CLEARANCE—ENGLISH STEREO 4-SPEED RECORD CHANGERS—£15/19/6

FREIGHT FORWARD

* * *

IMPORTED 4 SPEED TURNTABLES AND SEPARATE PICKUP— Latest Turnover type. Crystal Cartridge. **£8/17/ each.** Pack and post 3/6.

TORCH LAMPS—American—2.5 Volt ½ Ampere M.E.S. Base. Boxes of 10—**2/11.** Pack and post 7d.

SPECIAL— POWER TRANSFORMERS

50 m.a.—225-0-225V. 6.3V at 2A. **39/11.** Pack and post 2/9.
30 m.a.—150-0-150V 6.3V at 1.7A. **35/.** Pack and post 2/3.

STEPDOWN TRANSFORMERS

240/24V at ½ Ampere, 35/. 240/12V at 1.5 Ampere, **35/.**
240/6.3V at 3 Ampere, **27/6.**
Pack and post, any of the above, 2/.

* * *

W. F. ARE VICTORIAN DISTRIBUTORS FOR MAGNAVOX SPEAKERS

Write or call for Data Sheet describing these low priced top quality products.

12WR Dual Cone 10 Watts. 30-15KCS V/C Impedance 15 ohm. **£7/10/-.**
8WR Dual Cone 7 Watts. 30-15KCS V/C Impedance 15ohm. **£7.**
12PIX Dual Cone 10 Watts, 30-12KCS V/C Impedance 2.7 ohm. **£5/17/4**
8PIX Dual Cone 7 Watts. 30-12KCS V/C Impedance 2.7 ohm. **£4/9/8.**
Pack and Post 5/- each.

TELEVISION ANTENNA SPECIALS

INDOOR SPIRAL TYPE AERIALS. Ideal for good reception areas. **60/ each.** P. and P. 2/. 4 Element Outdoor Aerials suitable primary areas, Type AM1, **63/ each.** Freight forward. Chimney Bracket Sets—comprising Galv. Steel Bracket, 12ft Stainless Steel Strap, U Bolts and J Bolts, **28/.** Pack and post 2/6. 6ft x 1in Galv. Steel Masts, **12/.** Pack and post 2/6.

STAND OFF INSULATORS—12in—Metal Thread or Wood Screw, **1/ each or 10/ dozen.**

TURNBUCKLES—4in extending to 8in. **4/6 each or 48/ dozen.**

MASTSTRAPS—9d each or 7/6 dozen.

PLUGS AND SOCKETS—Surface type for 300 ohms Ribbon. Walnut only. **3/9 pr. or 42/ dozen.**

300 ohms Ribbon—100 yard Reels—**59/6 each.** Freight forward. Black or Clear.

OPEN LINE Feeder Cable 300 ohms—Will improve reception in fringe areas where ordinary Ribbon is now being used. **62/6 per 100ft.** Pack and post 2/6.

OPEN LINE INSULATORS to suit. Metal Thread or Wood Thread. **1/10 each.**

3 ELEMENT TRAVELLING WAVE ANTENNAE. £4/19/6. F/Fwd.

TENNA TIES—HI-LO BAND CONNECTORS—2/11 each.

May also be used as attenuators. Post Free.

* * *

N.A.C. TELEPHONE SETS—New Grey Plastic Hand-sets with built-in Buzzers. Ideal for house to garage, shop to kitchen or inter-departmental communication, etc. Only extra required is Twin Flex for connection. **Price per pair £11/5/.** Pack and post 3/6.

TEST LEADS—Rubber-covered heavy duty Flex with high-quality Tips and Prods. **14/3 pair.** Pack and post 9d.

STEREO CRYSTAL PICKUP CARTRIDGES, IMPORTED COLLEL. With—Two Sapphire Stylii, 49/6. With—One Diamond Long Playing Stereo and—One Sapphire Standard Stylus,**99/4.**

WARBURTON FRANKI

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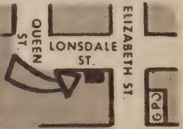

OPEN SATURDAY MORNINGS

PLEASE INCLUDE POSTAGE OR FREIGHT WITH ALL ORDERS

- TRADE ALSO SUPPLIED

ıke a round trip to Echo was ap-
nately 10 milli-seconds.

Moon's orbit about the earth is
approximately circular at a radius
d 240,000 miles.

Moon has a diameter of about
miles and subtends an angle of
½ a degree when viewed from
arth. The Moon travels at a speed
bout 2,300 miles per hour and
s a complete revolution in around
ıys. The slower speed and larger
nded angle make tracking easier
ıe Moon than for Echo.

Doppler shift is considerably
er the minimum shift being
he order of a few hundred
, for a carrier frequency of 2,400

a mathematical analysis using the
Propagation Formula W9BGZ
uded that the system requirements
signal bounce are not too greatly
ent for Echo and Moon signal
ing.

radar formula shows that, for a
nitter power output of 100 watts,
perating frequency of 2400 mc/s
dentical receiving and transmitting
nas, antenna gains of 45 dB are
red to receive CW signals when the
ver pass band is 100 cps.

abolas 30 feet in diameter would
de the required gain. For single
and the received signal power must
bout 20 times as large as for CW.
could be achieved if the diameter
e parabola was doubled. Either of
ounce modes presents a problem for
mateur or group on the evaluation
ded above.

EDERAL EXECUTIVE

E Federal Executive of the W.I.A.
for the year 1961-62 will comprise
ollowing officers: — Federal Presi-
Max Hull, VK3ZS; Federal Secre-
J. Lancaster, VK3JL; Federal
surer, Bob Bolse, VK3N1; also
ır Tinkler, VK3ZV, Dave Rankin,
QV, and Bill Mitchell VK3UM.

ey were nominated for the positions
ıe Headquarters Division, Victoria,
cordance with the constitution and
appointment endorsed by the
us State Divisions of the W.I.A.

e Federal Executive conducts the
s of the Institute at international
Commonwealth-wide levels. They
ment the decisions of the Federal
entions and other matters that have
voted upon by State Divisions. The
s are wide and varied and include
n with the P.M.G.'s Department.
teurs appreciate the great amount of
executive members spend working
ıeir behalf.

eparatory work is already proceed-
for next year's Federal convention
ıe WIA to be held in Perth. It is
two years since a similar meeting
been held and it is certain that a
ber of matters of Commonwealth-
importance will be debated. Divi-
have already been approached re-
ce the submitting of items for the
da paper. These conventions pro-
the opportunity for the exchange of
on a personal basis, a feature
ssary for complete understanding of
oints of view.

ıe arrangement is that initially items
the agenda paper are submitted by
ions to the Federal executive. These
hen listed and a complete copy forwarded back so that State divisions can instruct their delegate how to vote on each particular item at the convention.

N.S.W. DIVISION

MR BILL SIMMONDS of DCA lectured on communications at the general monthly meeting of the N.S.W. division held at Science House, Sydney. The lecturer provided much interesting data on the general trend of the types of transmission modes used and in use. Mr Simmonds said there was a marked increase in VHF operation, a decrease in CW working, and that SSB was being utilised for point to point circuits. The lecture was of great interest to members.

Visitors from interstate attending were Steve, VK5ZB, and Doug, VK4ZDR. General business concluded the ratification of the appointment of the Federal executive, discussion on Novice Licences and the VK2WI Dural station requirements.

The N.S.W. VHF and TV group's Nocturnal Fox Hunt resulted in a win for Paul, VK2ZPJ, and with Dave, VK2AWZ, second and Tim, VK2ZTM, in third place. Tim also arrived recording the shortest distance travelled. The fox was a combined effort by Kev, VK2ZFC, and Bob, VK2ZEL, and the lair suitably selected with four cars out of the 12 competing still taking bearings.

Visitors during the month to Administration H.Q. at Crow's Nest included VS1JW, who will become a VK4 within a few months, and Stuart Savage, VK2PL, from Griffith. The centre has become popular for Saturday afternoon visits to select the odd piece of disposals equipment and for a general rag chew.

SECTION MEETINGS

LECTURERS at meetings of N.S.W. sections included Harold Burtoft, VK2AHH, and Bob Lear, VK2ASZ. Harold lectured to the Central Coast Section of the WIA in May on his pet subject of antennas. He produced many charts and diagrams presented by means of the N.S.W. division's new projector. Bob lectured at the Blue Mts. Section meeting, where he described and displayed a 15-watt mobile transmitter covering all bands from 3.5 to 144 m/cs. A number of novel features was incorporated in the design.

IT is with regret the passing of Don Woodward, VK2ARX, of Woolwich, was recorded early in May. Active since the war, Don could mainly be heard on the 28 mc/s band, where he was well known to many overseas stations. The sympathy of amateurs is extended to his family in their loss.

R.S.G.B. SURVEY

A READERS' survey conducted by the R.S.G.B. provides engrossing information on the operating habits of our U.K. brothers.

The order of popularity of the various amateur bands is as follows:—14 mc/s, 1.8 mc/s, 3.5 mc/s, 7 mc/s, 21 mc/s, 28 mc/s, 144 mc/s, 420 mc/s and 70 mc/s. The high rating of 1.8 mc/s

KEY COMPONENTS

FOR YOUR

ALL TRANSISTOR CAR RADIO

R.C.S. RADIO PTY. LTD.

Roblan

JABEL

Printed circuit board, coils, IF transformers, metal case and dial.

Miniature 3-GANG CONDENSER 300 pf per section type RMG 3 x 300

Special driver transformer J60D and Speaker transformer J63S.

PRINTED CIRCUIT TAB MOUNTING

FROM RADIO TRADE HOUSES EVERYWHERE

Factory Distributors:

WATKIN WYNNE PTY. LTD.

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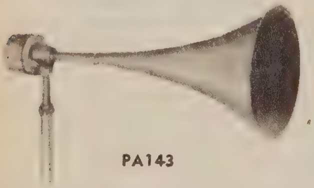
REPRESENTATIVES IN ALL STATES OF COMMONWEALTH.

Sound Distribution SPEAKERS

AWA manufacture the most complete range of speaker assemblies—there's a unit for every sound reinforcement need. AWA designs these speakers for maximum faithfulness in sound reproduction. Styles and finishes are available from stock or designed for individual use and circumstance.

PA138

Standard reflex horn speaker for medium distance projection of speech and incidental music.



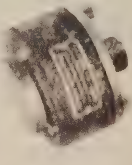
PA143

Short exponential horn speaker for distance projection of speech only.

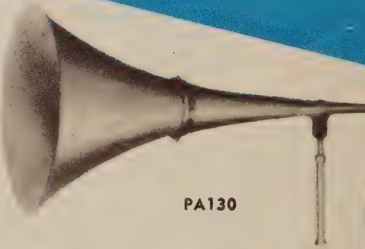
Ivory timber cabinet with 7in speaker for applications where a bidirectional characteristic is desired.

PA73

RESLO DRIVE UNITS
SU10 & SU12



Exclusive features are the self-locating diaphragm and the concentrically interlocked magnet which together produce an undisplaceable mechanical assembly proof against decentering.



PA130

PA108 & PA1

Standard exponential horn speaker for public address where distance projection of speech and incidental music is required.

These flare baffles are for use with 7in and 12in permanent magnet co speaker units and provide high conversion efficiency.

PA77/12PS

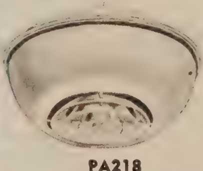
Polished timber cabinet for wall or table mounting with 12in cone speaker and 600 ohm line transformer.

PA150/1

Attractive moulded cabinet with 7in cone speaker and 600 ohm line transformer. Suitable for wall or desk mounting. In grey, ivory and walnut.

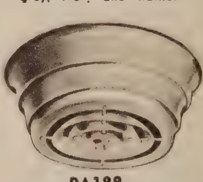
PA343

General purpose source reproducer fa music and speech ra 100 to 7,000 cyc Power capability 15 w of programme.



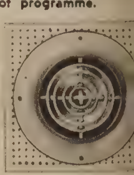
PA218

Designed for overhead mounting in contemporary styling. The unit can be suspended by chain or rod. Gives uniform response over a wide area.



PA188

For overhead mounting this is a surface style unit. 360-degree diffusion over a wide area. In smart styling to suit modern architectural treatments.



PA186

For flush mounting unit has a rece acoustic surround w mounts the complete sembly above the cei line. 360-degree d sion.

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITE

554 Parramatta Road, Ashfield. UA0791. 167 Queen Street, Melbourne. MU91
Cnr. William and Newcastle Sts., Perth 28-3426.
123 Murray Street, Hobart. Phone 3-3836.
69-71 George Street, Launceston. Phone 2-5809.

Available in other States from:
Newton McLaren Ltd., Adelaide. • Chandlers Pty. Ltd., Brisbane.
Also from leading wholesalers.

l surprise most VKs. They ap-
tly don't suffer from QRN in the
Working DX provides an interest
) per cent of the amateurs that re-
while VHF operation is attracting
creasing number of supporters each

bile operation is also increasing in
arity as shown from previous sur-
All members returning the sheet
they used AM telephony, 80 per
used CW as well. Nine per cent
ng transmitted SSB. The most
ar articles published in the
.B. Bulletin were both written by
AF, the first describing an SSB
nitter, the second covering com-
ations receiver design. Eighty per
of members build most of their
equipment and constructional work
n important interest with the
ity.

cept for the popularity rating of
ands the above comment would
fairly accurately the practices of
ustralian amateur.

PERATION GOODWILL

CLE Dave, W2APF, who has met
many amateurs in Australia during
ips to these parts has commenced
is termed an "Operation Good-
The scheme operates as follows:
lephone he takes messages from
es and friends of servicemen
as and records them on tape. He
mails the tape to the serviceman
rned with the necessary playing in-
ons and requests that a reply be
Uncle Dave on the receipt of
pe then proceeds to send the reply
e telephone to the persons concern-

advance of sending the tape over-
n amateur radiogram is dispatch-
the serviceman warning him of the
ng. Not quite a normal amateur
e but certainly a good-will effort,
Uncle Dave's expense.

DX HONORS

two amateurs who originally
eached the 300 country mark on
RRL's DXCC Honour Roll, Jock
, ZL2GX, and Chas Mellon,
I, back in 1960, are now well down
W list. On top now are W8JIN
Y2CK both with 306 confirmed.
atter also has a similar number of
ies confirmed on Telephony.
stations on the CW list with more
300 countries listed are W4DQH
W3JNN and W3GHD, 304,
MB, KV4AA and W6AM 303,
JQ, CE3AG, W8BKP and W9RBI
and W9NDA, W5ADZ and
KA, 301. Judging from the W3's,
etc., now appearing, it looks as
me of the corn-fed Californian
atts must have migrated to the
Coast.

EMERGENCY NET

R.A.E.N. the Amateur Emer-
ency Net of the R.S.G.B. were
ded during 1960 by the general
ent weather of the necessity of
fully organised at all times. Al-
no major disasters were record-
ny areas of the country experienc-
al flooding and the Net was alert-

ny groups are using two bands
ly 1.8 and 144 Mc/s) with rea-
e efficiency. Despite the comments offered by LF or VHF purists on the problems of dual band working, the system functions.

It has the advantage of attracting more members into the nets and satisfactory message handling facilities can be arranged after suitable experiments. The net is divided into districts under R.A.E.N. controllers and it is their responsibility to work up the group into an efficient body that can meet the communications demand during a sudden local disaster. Considerable amounts of their practice operation is conducted in co-operation with police groups and available mobiles play an important part in this working.

UN AWARD

THE Worked United Nations Award is now available in four classes—1, 2, 3 and novice. The applicant for this award must contact nations that have membership in the United Nations. The required number for the four classes being 70, 55, 40 and 10 respectively. QSL cards need not be sent but the list submitted must be certified by two members of the DXCC or an officer of a recognised society or radio club. Applications for the award together with seven IRC's should be sent to W01UB, T Harmon, 5019 Gramar, Wichita 18, Kansas, U.S.A.

Even the U.S.S.R. amateurs are in the operating award field and the W-10-W certificate is available to any operator contacting 10 UC2 stations in Minsk. The list of cards certified by another amateur should be forwarded to W. P. Pristanko, P.O. Box 71, Minsk, Byelorussia, U.S.S.R. when claiming the award.

1.8 AND 3.5 Mc WORKING

THE first WBE award for 1.8 Mc/s band operating has been awarded to W1BB and this band is becoming increasingly popular for DX working. The 3.5 Mc/s band has provided some interesting SSB contacts, a number having been made between G and ZL amateurs. G2HX has quite an impressive list using this mode on 3.5 Mc/s. Prefixes include all W and VE, KH6, KL7, ZL and YV.

Contacts across the Atlantic on SSB are commonplace with G2HX recording 10 in a 20-minute period.

We supply **Radio Accessories**, including Valves, Resistors, Condensers, Transformers, Players and Changers etc., also Sets. **Television Accessories**, including Picture Tubes, Valves. Antennas, Tuners, etc.

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Transistor Sets, Miniature 6, Mantel 6 and 7 Car Sets, Car Aerials.

Open week days, 9 to 5; Saturdays, 9 to 12.

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as illustrated
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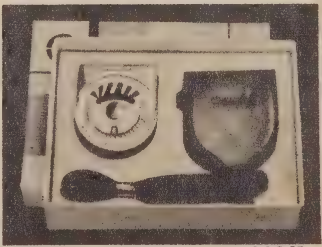

CAPITAL EXPOSURE METER
Asa Exposure Index 3-1600
Lens stop f1 to f32
Shutter speeds 16 sec. to
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in leather case
As illustrated £3/9/9

P.F.1 FLASHGLOBES 5'- per packet of 5

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IN HI-FI TAPE RECORDERS

THE COMPLETE UNIT IS SUPPLIED IN ATTRACTIVE AND DURABLE TWO-TONE COVERED CASE COMPLETE WITH ACOS MICROPHONE AND FITTED WITH DUAL ROLA SPEAKERS.

The amplifier incorporates the latest "Mullard" tape recorder circuit equalised to C.C.R. standards giving perfect reproduction from recorded tapes. Outlet to power amplifier. Extension speaker outlet and "magic eye" level indicator. Amplifier is completely shielded and fitted with dress plate to match deck. Output: 4 watts can be used as straight amplifier if required.

Model TR2 incorporates the ne Collaro "Studio" Deck whic features:–

- **High Fidelity. Frequency response 40 to 12,000 cycles 7½in per second.**
- **Three 4-pole shielded motors.**
- **Three speeds, 1-7/8, 3¾ and 7½.**
- **Fast forward and rewind, 1200ft in 65 seconds.**
- **Two track.**
- **Light piano key controls.**
- **PAUSE CONTROL**

This has the effect of stopping the transit of the tape past the "Reco Playback" and "Erase" heads and applying the brakes to the spools w leaving all switches and mechanical functions in their selected positi Typical application is to pause whilst recording to omit speech interpo between musical selections. Control will only work whilst it is in position.

- **TAPE MEASURE AND CALIBRATING DEVICE**

The three digit counter makes the location of any recorded passage simplest of operations.

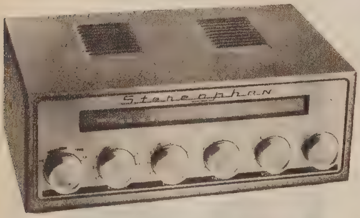
- **TRANSCRIPTION TECHNIQUE**

A large diameter flywheel with ground and lapped steel shaft running o ball at the bottom of long bearing reduces friction and virtually elimin "wow" and flutter at less than 0.15 per cent at 7½in per second.

COMPLETE RECORDER WITH MIKE 69 GNS. f.o.r.

A COMPLETE HI-FI STEREO SYSTEM FOR ONLY 59 GNS. F.O.R

UNIT STEREO PLAYMASTER AMPLIFIER No. 2 WITH PLAYMASTER TUNER



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- **Output 7 watts per channel (14 watts).**
- **Ferguson Output Transformers.**
- **Inbuilt Tuner with new EM 84 tuning indicator, frequency coverage 550 1,600 KC.**
- **Valves 4 6BM8—1 12AUF—1 6N8—1 6AN7—1 EM84—2 1N1763 Re fiers.**
- **Supplied in self-contained case finished in beige, hammertone, with bl and gold control panel with matching knobs.**
- **Switching and input facilities for pick-up—radio, F.M. Tuner and T Recorder.**

Also available in polished cabinet, with maple, walnut or rosewood finish 75/- extra.

PLUS THE NEW B.S.R.-UA12 OR GARRARD STEREO CHANGER

AND TWO MAGNAVOX 8W.R. HI-FI SPEAKERS GIVING A FREQUENCY RESPONSE OF 40 TO 12,000 CYCLES

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CLASSIC RADIO TAKE PRIDE IN ANNOUNCING COMPLETE RANGE OF STEREOPHONIC EQUIPMENT

Stereophon LIVING SOUND

16 VALVE HI-FI STEREOGRAM CHASSIS

lete tuner and amplifier for stereo, comprising a compact Hi-Fi Stereogram in two units featuring a high gain wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls in one unit and Mullard 5-10 amplifiers with push-pull outputs and power supply on second chassis. **£69/15/-** F.O.R.

pair of M.S.P. Jensen speakers or two Rola 12in dual coned speakers supplied. Power output 10 watts per channel (20 watts). Frequency se of amplifier 40 to 15,000 cycles.

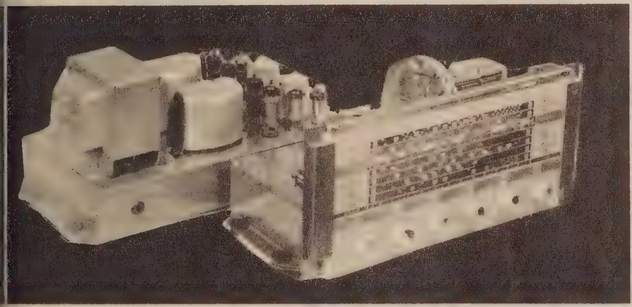
THIS UNIT CAN NOW BE SUPPLIED WITH THE NEW ROLA 12 PX SPEAKERS

10 VALVE HI-FI STEREOGRAM CHASSIS

lete stereo unit comprising dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with controls and two Mullard 3-3 amplifiers, power supply on separate chassis. Supplied with two Rola 8MX rs. Power output 4 watts per channel. Frequency response of amplifier 40 to 15,000 cycles. **£49/15/-** F.O.R.

8 VALVE HI-FI STEREOGRAM CHASSIS

lete tuner and amplifier for stereo incorporating the "Mullard 2-2" amplifier circuit with separate bass and controls. Output 3 watts per channel. Supplied with two Rola 8MX speakers. Frequency response 50 to cycles. **£41/15/-** F.O.R.



ALL UNITS INCORPORATE THE NOW FAMOUS "MULLARD" AMPLIFIER & TONE CONTROL CIRCUITS.

Write for Full Specifications of STEREOPHONIC EQUIPMENT OR TAPE RECORDERS

SPECIFICATIONS OF OUR NEW HI-FI CHASSIS

EW:

nodern circuit using high gain valves including "magic eye" tuning tor. Permatuned iron cored coils and intermediates giving excel- nterstate reception and a short-wave range of 12,000 miles. All used are the new Mullard nine-pin Innoval series.

EW:

control and audio stages incorporating the Mullard 5/10 amplifier with separate bass and treble controls giving plus or minus boost or cut at 50 cycles L.F. and 10,000 H.F., combined with oull output with inverse feed-back gives you really high fidelity luction from your radio or favourite recordings.

EW:

speaker combination using the new Jensen M.S.P. 12PR woofer matched tweeter and cross-over network giving a frequency se of 40 to 12,000 cycles. If required the Rola 12MX speakers can pplied (with the 8 valve stereo chassis, two Rola 8MX speakers are ed). A.W.A. output transformers used on all units.

NEW:

Six position selector switch is incorporated in all chassis with compensation for L.P. recordings and provision for stereo F.M., or TV tuners and tape recorder.

NEW:

Large calibrated edge-lit dial in perspex (11in x 6in) with main stations of each State in prominent type. Dial fitted with counterweight drive, giving smooth tuning. Dial supplied in cream with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW:

Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate, overseas and country stations.
All chassis age wired for the fitting of F.M. tuner or tape recorder, special plug being provided on back of chassis, also pick-up terminals and outlet for gramo. motor.
Power switch is fitted to volume control. Audio end of set can be used with TV receiver if required.

MPLETE RANGE OF DUAL, COLLARO, B.S.R. AND GARRARD, STEREO PLAYING EQUIPMENT IN STOCK

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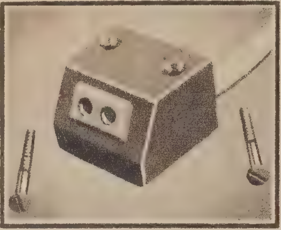
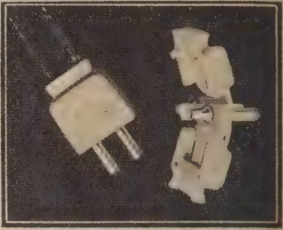
High stardards of design and manufacture ensure positive connection for the whole life of the component.



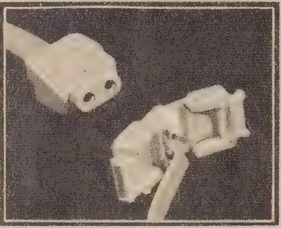


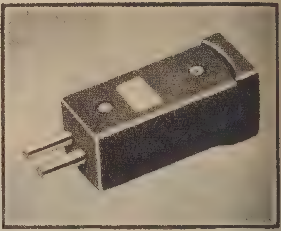
OUTLET BOX

Provides neat termination of 300-ohm ribbon feeder. Robust metal casing finished in bronze. Silver-plated contact sockets. Connections may be soldered or crimped. (LA5006.)

PLUG

A quick loading plug allowing soldered or crimped connection to 300-ohm feeder. Solid pins silver-plated for low contact resistance. (LA5007.)





SOCKET

Similar to LA 5007, having sockets in place of the pins to allow positive joints to be made in 300-ohm feeder. (LA5008.)

ATTENUATOR

Designed to interpose between LA 5006 or LA 5008 and LA 5007 where it is required to reduce the signal level: e.g., when high aerial directivity is required without the consequent increase in signal. Attenuation in values of 6, 12, 18 and 24 db. (LA5011/.)

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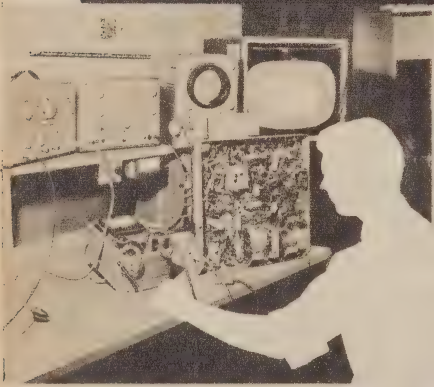

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N SHORTWAVE — By ART CUSHEN

G.M.T. First Recognised In 1884

e adoption of the use of GMT on this page, has brought to mind ne interesting details on the use of time measurement on a world-wide scale.

measurement of time first started ith the sun; when, at its highest n the sky, it was noon. The stars, ossing a line from the north pole south pole gave further indication e.

standard time measurement today uartz crystal clock. Its principal ple; the crystal oscillates at (usu-00,000 cycles per second, and this tronically subdivided to one oscil- per second. At the Greenwich ob-ory 18 such clocks are used and erage time is the one recognised.

original idea of the Greenwich atory was to assist in naviga-n 1675 a proclamation was issued struct the observatory, and Chris- Wren was given the job of de- the building.

invention of the telegraph called curate time, as also did the establ-nt of rail and road transport ser-

1852 the first electric clock was d in London and, by this time, rdisation of time in the United om had become essential.

al time in the United Kingdom revalent, and this meant for every of longitude a difference of four s. In Cornwall, local time was nutes behind the time in London.

.T. became the authorised time tain in 1880. In 1884 Greenwich ade the prime meridian, at a con- in Washington, with some coun-ot agreeing on it. In 1912, at an tional conference, the use of wich Mean Time was recommend- all time signals, and its world-adoption was assured.

ROADCASTS FROM MADRID

DIO Nacional de Espania, broad-sting from Madrid, has been in new programs in Arabic, which amed to Morocco. The station uses Kc and the times are 1315, 1800 245 G.M.T. As well as being in , some French is used in the , Madrid, with its service in Span- South America using 11815Kc, d to closing at 0300 G.M.T. while, rth America in English, strong are noted on 9368 and 6130Kc. essions are broadcast from 0315- 0415-0500 and 0515-0600.

ARATONGA USING 9696Kc

EW frequency is being used by K1ZA at Raratonga with its asts to the Cook Islands. The is on the air from 1900 to 1930, nformation from the station indicates an extension of this program time soon to include the broadcasts to schools. The signals on the lower frequency, 5050Kc used at night, due to the mountainous nature of the main island, do not give good coverage. It is expected that a broadcast band frequency may be put into service soon. ZK1ZA is being heard at the moment on Thursday from 0430 to 0630 using 5050Kc, the program at the end of the transmission is in English, and includes a religious session before the station closes. Transmitter site was recently shifted from Black Rock to Avarua, which is on the central north coast, and 3½ miles east of the old location.

VOICE OF CUBA

THE long promised 100Kw transmitters in Havana have been heard with experimental broadcasts in the 25 metre band; the frequency varies from 11760 to 11772 Kc. The station has been heard with Spanish programs, and is followed from 0200 to sign off at 0410. The station identifies as the "Cuban Experimental Radio," and asks for reports to be sent to P.O. Box 7026, Havana. The station in this area, though of good strength, is continuously jammed. This makes reception and details on the program difficult to copy.

OAX6E USES 9355Kc

A NEW frequency for the broadcasts of "Radio Continental" in Arequipa have been noted in the afternoon listening, when the signal has been heard on 9355Kc. The station, which also operates OAX6E on 6330Kc, has used a 90 metre frequency for some years, but this channel seems to be a replacement. The station, in Spanish, has been asking for reports on the reception of this new 31 metre outlet, and these should be sent to the Director, "Radio Continental," Arequipa, Peru. The station has been noted at best strength at 0400, when usual commercial programs are broadcast but, at times, it does not leave the air until 0600. The frequency is one which has, for some years, been used by the Cuban station COBC "Radio Progresso" in Havana, but the nationalisation of Cuban radio has resulted in its disappearance from the short wave bands.

AUSTRIAN BROADCASTS

THE high-powered transmitter of the Austrian Broadcasting Service is still broadcasting on an experimental basis, and the best reception is on 6155 Kc in the period 0500 to 0800 G.M.T. The full schedule of the Vienna transmissions are: 6155 Kc., 0500-0800, 1400-1600 and 1800-2100; on 7200 Kc. from 1000-1200; 7245 Kc., 0800-1000 and 1200-1400; on 9770 Kc. from 1500 to 1800 G.M.T. Reports on reception are appreciated from listeners and these should be sent to the Austrian Short Wave Service, P.O. Box 700, Vienna 50, Austria.

FLASHES FROM EVERYWHERE

JORDAN with broadcasts from Amman has been heard with test broadcasts to North America from 0130 to 0315 when using 7155 Kc. The station identifies in English, and asks for reports to be sent to Box 909 in Amman, Jordan. This station has been heard in this transmission for the past few weeks, but in this area the frequency gives better reception to sign off at 0600, when the session is in Arabic.

MONACO station of Transworld Radio has dropped in frequency from 9705 to 9690Kc., and it uses the channel for the English session on the air from 0730 to 0800. The station appreciates reports to Box 145, Monte Carlo, Monaco.

OMDURMAN in the Sudan is being heard on 9505 Kc., when sign on is at 0400 G.M.T. Signals are spoiled by the severe side interference of XEWW using 9500Kc. and broadcasting from Mexico City.

ATHENS in Greece, which has a short session for listeners in Europe in English and French has made a frequency change. The session is now on 15345 and 17775 Kc., for the period 1720 to 1740 G.M.T. A report from Switzerland states the 17775 Kc. outlet is very well received.

DELHI with the external broadcasts of All India Radio has extended its schedule to South-East Asia by 30 minutes. The session is now broadcast 1330 to 1500 G.M.T. Delhi's first transmission for Australia, New Zealand, China and Japan, is now carried on 15160, 15310, 17705, 17725 and 21615 Kc., and is broadcast from 1000 to 1100 G.M.T.

ALGIERIAN Freedom Radio broadcasts on 8220 Kc. from 2000 to 2130 in Arabic, except 2015-2030, when the session is in French. The F.L.N. Radio is now also heard on 8895 Kc. from 1930 to 2130 G.M.T.

OSLO in its transmissions in the 13 metre band has been noted on the new frequency of 21730 Kc. This frequency replaces 21670 Kc. in the session 1100-1220, 1300-1420, 1600-2100 G.M.T.

TUNISIA, with broadcasts from Tunis is now on the air 0400-0800 on 11970 Kc., 1100-1530 on 17720 Kc., 1600-2300 on 11970 Kc. The programs throughout are in Arabic. A further frequency of 5985 Kc has been heard at 2110 G.M.T.

FINLAND with its transmissions from Helsinkie is broadcast in English to North America, from 1100-1430 using the new frequency of 11960 Kc., as well as 15190 and 17800 Kc. The transmission on Monday and Friday is on the air from 1100.

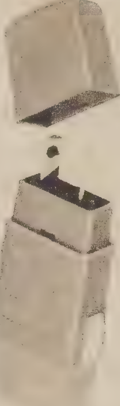
MELBOURNE with its broadcasts

Beautifully Finished and Highly Sensitive

MULTIMETER TESTERS

EXCLUSIVE TO RADIO HOUSE PTY. LTD.

(Handy Size)



RECHARGEABLE TORCH

Save the cost of batteries. This thin 3in pocket-sized torch incorporates a rechargeable battery which has an indefinite life. Operates for long periods between charging. When brilliance of light weakens, just remove back cover and plug into any power point.

Recharges overnight. No corrosion, no wires. Can be stored for long periods and still be ready for use.

Only 72/6

Spare Globe 2/6

MODEL RH-5 ▲

MODEL RH-5

- High sensitivity-20,000 Ohms/V DC 10,000 Ohms/V AC
- 3" Meter
- Handy pocketable size

SPECIFICATIONS

DC Voltages: 0-10-50-250-500-1000V (20,000 Ohms/V)
AC Voltages: 0-10-50-250-500-1000V (10,000 Ohms/V)
DC Current: 0-50uA, 0-5-50-500mA
Resistance: 0-10K, 0-100K, 0-1Meg, 0-10 Meg (62 Ohms, 620 Ohms, 6.2K, 62K at centre scale)
Capacitance: 0.0001uF-0.005uF 0.005uF-0.1uF
Decibels: minus 20db to plus 36db in 2 ranges
Dimensions: (3½" x 5¼" x 1⅜")
Weight: (15oz approx.)
Complete with internal battery, testing leads with prods.

PRICE £9

Including Sales Tax.

Speaker Unit with Volume Control
Price: £4/-/-.
Size: 3in x 4in.

TRANSISTOR TAPE RECORDER

Model 201 Minipex,

Dimensions: 5¾in x 3¾in x 1¾in. Fits into a pocket.

Priced **£15/15/-**

Complete with earphone and Mike combined

Fitted with batteries, Standard Torch Cell and 9 Volts Transistor Battery No. 216. Recording Time 9 minutes. 60ft full Track Tape' Standard recording Tape used 200ft for 9/6, enough to fill the supply reel 3 times. Spare reels available. Variable Speed Control. Erases Automatically as it records. Freq. response 300cps to 4000cps. Weight Approx. 1lb. Battery life: 5 hours Standard Cell, 80 hours Type 216.

MODEL RH-31

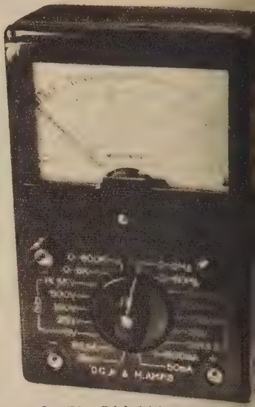
- 20,000 Ohms per Volt on DC
- 10,000 Ohms per Volt on AC
- 3½" Meter
- 18 position selector

SPECIFICATIONS

DC Voltages: 0-5-25-100-500-1000-5000 (20,000 Ohms/V)
AC Voltages: 0-5-25-100-500-1000V (10,000 Ohms/Volt)
DC Current:. 0-50 uA, 0-5-50-500mA
Resistance: 0-6K-600K, 0-6Meg-60Meg (30 Ohms, 3K, 30K, 440K at centre scale)
Capacitance: 100uuF--0.01uF, 0.002uF-0.3uF
Inductance: 20 H to 2000 H
Decibels: minus 20db to plus 30db in 2 ranges
Output Jack: for Audio measurements
Dimensions: (3⅞" x 5⅞" x 2 3-8")
Weight: (23oz approx.)
Complete with internal battery and testing leads with prods.

PRICE £10/12/6

Including Sales Tax.



MODEL RH-200 ▲

MODEL RH-200

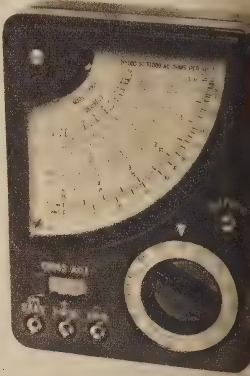
20,000 Ohms per Volt DC
10,000 Ohms per Volt AC

SPECIFICATIONS

DC Volt: 0-5, 0-25, 0-50, 0-250, 0-500, 0-2,500
AC Volt: 0-10, 0-50, 0-100, 0-500, 0-1,000
DC Current: 0-50, Microampe res. 0-25, 0-250 Milliamperes
Resistance: 0-60K Ohms, 0-6Meg Ohms
Capacity: 0.01-0.3mfd (at AC 5 Volt) 0.0001-0.01mfd (at AC 250 Volt)
Decibel: minus 20db plus 22db
Output Range: 0-10, 0-50, 0-100, 0-500, 0-1,000
Battery used: UM-3-1.5V, 1 piece
Dimensions: 3¼" x 4½" x 1 1-8"
Complete with internal battery, testing leads and prods.

PRICE £7/10/-

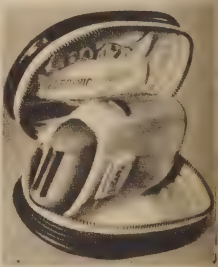
Including Sales Tax.



MODEL 200-H ▲

SHAVER

This electric type shaver operates from two 935 standard torch batteries fitted inside the shaver. No wires or outside power; just switch ON and shave. Head easily removed for cleaning.



Complete with batteries, £2/19/6

Spare batteries, 2/10.

RADIO HOUSE PTY. LT

296 PITT STREET, SYDNEY.
Also at 760 George St., and 6 Royal Arcade.

Radio Australia has taken over a frequency, when the present I.T.U. went into effect last month. Radio tralia now uses 9565 Kc., will carry English program from 0858 to 0 G.M.T.; this program was formerly 9580 Kc. The programs from 0958 apanese to 1100, and then in Eng- formerly on 9570, will now be idcast on 9580 Kc. The calls are E9 9565 and VLD9 9580 Kc.

EOPOLDVILLE in the Congo, ch operates on 11755 Kc. is the old .C. transmitter according to an an- ncement from the station, and re- ed by Radio Australia. The station ounced that a further 100Kw. trans- er will soon be installed, and it will extend its service to North America.

OLOMBO, with broadcasts of Radio lon, has altered its service to South- Asia. This was formerly broadcast the Commercial Service, but is now ied on the Radio Ceylon National gram. The new service is broadcast 17830 Kc. from 0930 to 1030 daily.

IOTES from readers should be sent Arthur Cushen, 212 Earn Street, nvercargill, N.Z. All times are in .M.T., 8 hours behind Western ustralia, 10 hours behind Eastern ustralia, and 12 hours behind New ealand time.

OGOTA station Radio Sutatenza, rated by a Catholic Mission, was ed over Easter with broadcasts at cial times. On Easter Sunday the ion broadcast midnight Mass from 0 to 0550 G.M.T. Three frequencies e noted in use, 6075, 5095 and 5070 The station has also a frequency 3250 Kc., but this was too low for eption at the time of the broadcasts. calls are HJGG on 5070 Kc., HJGC 5095 Kc. and HJGT using 6075 Kc. address of the station Radio Sutan- a, Apartado Nacional 3262, Bogota, ombia.

EW YORK with the broadcasts from meetings of the United Nations io is now carrying the proceedings the following schedule: To Europe English and French from 1530-1730 .T., on 21,690 Kc, 1530-1800 on 10Kc, 2000-2315 on 11,955Kc. To ica also in English and French from 0-1700 on 17,710Kc, 21,610Kc; 0-2400 using 21,735Kc; 2000-0015 17,800Kc; from 0015-0345 on 11,970 Latin America in Spanish from 1530 1800 on 21,465; 2000-2300 using 90Kc.

VRUL in New York has its DX pro- nme, which is scripted from the gazine "DXing Horizons" on the air third Saturday of every month. The ion to Europe is 1945-2000 using 90, 15,380, 17,750 Kc. The session South America is from 2315 to 2330 on 11,855, 15,380, 17,750, 17,845

JIBOUTI in French Somaliland is g heard with a program in Arabic on 0 Kc. The reception of this program been from 1900 to 2000 G.M.T.

HODESIAN signals at 1800 hours n news in English is carried, is g received on three frequencies, rding to a Swiss report. The trans- sions are on Lusaka 3346 Kc, Lusaka 6 and over a relay on 3954 Kc. stations have different programs ept for the news bulletin.

ATANGA is heard on its home pro- ms on 5933 Kc from 1700 to 1900 a program in French. This is the low-powered signal. Katanga from Elisabethville is still heard on its 100Kw outlet using 11,865 Kc and heard from 0500 G.M.T.

LISBON in Portugal is being heard with good signals on 6025 Kc with a transmission in Portuguese to North America. The station closes at 0400 G.M.T. and, when leaving the air, a clock chimes five and the Portuguese National Anthem.

BRUSSELS uses 11,850 Kc at 0045 G.M.T., when the station has a news bulletin in English; at 00.55 hours the Oslo Norway identification signal can be heard. Brussels leaves the air at 0100 and Norway is then received without interference opening its transmission to North America. This broadcast opens with English identification and, for the first part of the transmission, the program is in Norwegian. Both signals are well received and planning such as this enables the use of the one frequency 11,850 Kc to be used by two stations without the usual interference to each other.

CAPE VERDE ISLAND over CR4AA, has been heard in Europe, at 2230, when the B.B.C. using 3952 Kc signed off the air, leaving the CR4AA signal clear. The signal is on 3954 Kc slightly lower than its assigned 3960 Kc frequency.

LIBERIAN nation ELWA in Monrovia has moved from 15,085 to 15,155 Kc, in its transmission on the air to North Africa from 2000 to 2230 G.M.T. French is at 2000, Arabic 2100 and Portuguese at 2200 G.M.T.

CAIRO to Europe from 1900 to 2230 is now on 11,917 Kc; this measured frequency has the English session at 2130.

GOA has been heard on 21,680 Kc, when it commences its transmission on 21,680 Kc, from 1630 G.M.T. On Sunday interference is from Paris using the same frequency to 1700; after this Goa in Portuguese India is received clear of interference.

ICELAND over its new frequency 11,780 Kc is being received from 1930 G.M.T. onwards. This transmission in Icelandic is broadcast on this relatively new frequency which, in this area, suffers from considerable interference.

SINGAPORE has increased its schedule in its daily hours of broadcasting, when all three services are carried from 2230 to 1630 G.M.T. Our reception of the English news on 1230 G.M.T., when the frequency of 4820 Kc was tuned, provided us with a good signal.

ANGOLA National Radio is on 9765 and 4955 Kc. According to the World Radio Handbook, the station operates Monday to Saturday from 1100 to 1330, Sundays from 1100 to 1700. Using 6,025 and 4955 Kc, the broadcasts are 1800 to 2230, while on 17,705 Kc the station is on the air 2100 to 2230 G.M.T.

MANILA station DZUP, which had its short-wave relay on 7240 Kc and which has been heard widely in this area, has altered its frequency. The station, the "Voice of the State University," has moved from 7240 to 7160 Kc. It has been noted in the program from 1000 to 1300 G.M.T., though this seems to be subject to extensions.

WINDWARD Island Broadcasting Service at St. George, in Grenada has programs beamed to listeners in Jamaica. From 1530 to 1730 and from 2000 to 2235 G.M.T., the frequency of 15,390 Kc is used and from 2245 to 0215, when 11,955 Kc is used.

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1D8	5/	6J6	12/6	12A6	7/6
1H6	5/	6J7	4/9	12J5	10/6
1J6	7/6	6K7	3/11	12K8	12/6
1K5	4/6	6K8	6/9	12SJ7	9/6
1K7	3/6	6L7	12/6	12SH7	10/6
1P5	1/6	6SF5	7/6	12SR7	4/6
1T4	4/6	6R7	12/	807	11/6
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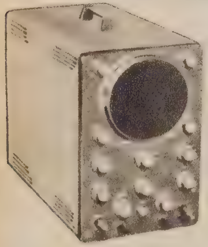
Input impedance: 1 megohm at 1 kc.
Accuracy: Within 5% of full scale.
Operates from 105-125v, A.C., 50/60 cycles.
Wgt.: 6lb. Size: 7⅜" x 4¾" x 4⅛".

PRICE: £36/12/-



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WF54/FP

NSWERS TO CORRESPONDENTS

EW COIL FOR AN IMPORTED SET

, West Heidelberg, Vic., asks our on a coil suitable for replacing ed in receiver of English design, ants to know does the iron dust such a coil affect the reaction g.

Well, J.W., the information you iven is not sufficiently comprehen- enable us to decide just what the used for. It would seem, however, e receiver is a simple one em- normal reaction and designed to he broadcast band. If such is the any commercial Reinartz coil probably fill the bill, the tuning capacitor being altered to suit the coil chosen.

The majority of locally available coils are designed for use with a standard tuning gang with a range of something like 12 to 450 pF.

The iron-dust slug sometimes used in these coils is so fitted that it only travels into the secondary winding of the coil and does not actually come into the vicinity of the reaction winding. If it did, however, the only effect would be, possibly, to increase the coupling between the secondary and reaction windings and modify the setting of the reaction control.

. B. (Leeton, N.S.W.), sends us a of appreciation regarding the e All-Wave Receiver," of August, He has recently assisted in the ction of one of these sets, and re- hat results are very pleasing.

Thanks for the letter, B. J. B. It ys very pleasing to learn that our are constructed satisfactorily, rform well.

★ ★ ★

R. (Deewhy, N.S.W.) says he is reader who is interested in using ith "Playmaster" Amplifiers.

Thank you for your letter, R.C.R., r your comments. We agree that corders seem to be enjoying a nce of popularity. By this time ll have seen the Playmaster Tape r.

★ ★ ★

(Thulimbah, Qld.) is anxious to design published for a sensitive ective amateur receiver, or, alter- , for an IF channel, which could d with separate converters.

We are looking into this whole n right now and hope to come h something soon. However, the is far from being a simple one, rmance is to be combined with asonable economy.

★ ★ ★

(Oaklands, N.S.W.) asks about difficulty he is having with the uitar Amplifier. The plates of W6 output valves were red hot ation, and he was able to mea- positive voltage on the grids of alves. Replacing the coupling ca- eased the situation somewhat, still feels that things are not should be. He also raises a about one of the photographs Transistor Stereo Player.

ou mentioned using old coupling rs, J.W., and we feel that herein r trouble. It should not be pos- measure any DC voltage at all the grids of the output valves und. Any positive voltage at all, ter how slight, is usually indica- a leaky coupling capacitor, and st then be replaced. Old capaci- e particularly prone to leakage . The grid bias voltage is actual- voltage developed across the resistor, and measuring this volt- l indicate the grid bias voltage ears between grid and cathode.

We suggest that you rectify the previous trouble before deciding whether the amplifier requires more treble response.

The leads in the photograph referred to go to the battery, speaker sockets and pick-up input and we felt no identification was really warranted. We suggest you contact the Public Library for the magazine you inquired about.

★ ★ ★

F.H.M. (Brisbane Qld.) says he is delighted with the results from our 5-Valve Stereogram as described in the April, 1959, issue. He mentions, however, that in the interests of stability it was necessary to return the negative ends of the 25 mfd capacitors directly to earth.

A.: We are glad to note that you are pleased with the receiver, but, in making the allegedly slight change, you have eliminated the negative feedback and the balance provision between channels, every effort should be made to restore the circuit to its original form. Our tip is that you have not phased the feedback correctly, so that it is actually positive, thereby requiring the alteration you mention. Try reversing the connections to the secondary of the output transformers, checking the amplifiers one at a time. The correct connection is the one which causes a reduction in gain when the feedback is in circuit.

★ ★ ★

G.C. (Campbelltown, N.S.W.) writes that having built the "Three Transistor Mantel" of March, 1959, he is troubled by a continuous whistle when the set is in operation. He asks if we can suggest the cause of this whistle.

A: It would appear to be excessive regeneration, G.C., caused by too much feedback being applied to the RF stage. If the whistle is still apparent when the regeneration control is turned down, however, this would appear to be ruled out and we would suggest you investigate two audio stages for possible audio oscillation. If the whistle does turn out to be excessive feedback, simply turning down the regeneration control will enable you to remove it.

RADIO, TELEVISION AND HOBBIES QUERY SERVICE

TO assist our readers, "Radio, Television and Hobbies" conducts a technical query service. Conditions governing this service are set out below:—

(1) Requests for copies of circuits or technical queries requiring an answer through the post must be accompanied by postal note or stamps to the value of TWO SHILLINGS. Queries not accompanied by a fee will be answered in rotation on these pages.

(2) For the 2/ fee, we will supply circuit data, as available, for up to three projects. The amount of data available varies, but in no case can it include information additional to that already published in the magazine. As a rule, requests for circuits will be answered more speedily if they are clearly identified and not complicated by questions requiring the attention of technical personnel.

(3) The technical query service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits.

(4) The Editor reserves the right to return query fees or to limit the scope of an individual reply, where it is felt that a partial answer will be better than none at all. Please note that the inclusion of an extra fee does NOT entitle correspondents to special consideration.

(5) In addition to the normal query service, chassis blueprints are available for most of our projects, showing the position of all holes and cutouts for metal-working but containing no details of wiring, etc. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost 5/ each. Original photographs of most projects are also available, from 5/ for a 6in x 8in glossy print; postage 9d extra.

(6) Letters should be addressed to the Technical Editor, "Radio, Television and Hobbies," Box 2728, G.P.O., Sydney.

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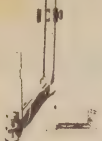

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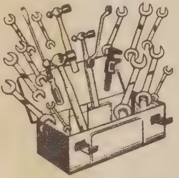

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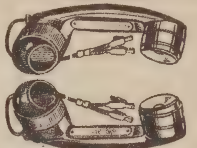

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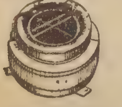

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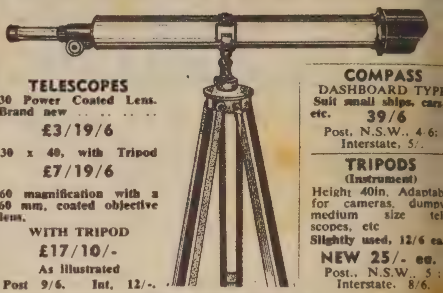

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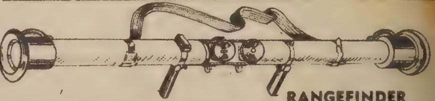

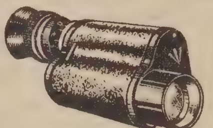

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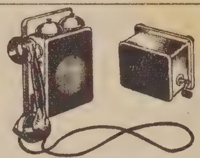

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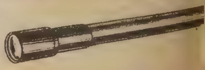
COMPLETE TRANSMITTER NO. 153

A.W.A. type J51050 comprisin R.F. unit, power control and mino rectifier unit and main rectifie unit, with spares. 100 watt R.T 300 watt C.W. Crystal controlle 2 to 20 megs, with power supply 110 or 240 volt A.C. 50 cycle New. Will transmit over 500-mil range daytime. World range night Original cost £2,000. Heavy-dut wide band aerial included.

£125 COMPLETE

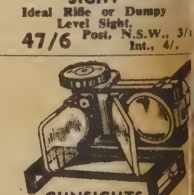
SECOND HAND £75 eac



TELESCOPIC SIGHT

Ideal Rifle or Dumpy Level Sight.

47/6 Post, N.S.W., 3/ Int., 4/.



GUNSIGHTS

Contain these lenses:
1 lens 1in Focus, ½in diam.
1 Lens 1 11/16in Focus, 1¼in di
1 Air Spaced Lens, 1¼in diam
1 Filter Lens, 1 Graticule.
1 Lampholder.

18/6 each Post: N.S.W. 2/6; Int., 3/

DEITCH BROS.

70 OXFORD STREET, SYDNEY

Between Crown and Riley Streets, City.

DERGROUND WATER

(Continued from page 14)

and lightly driven into the sand t is tight.

forms a core equal in length to pth to which the pipe is driven ie sand or gravel, and enables a "core" of the formation to be ed from the casing for examina-

core is extracted from the casing special tool called a sand pump

n water has been found, it is d and, together with the informa- ained from examination of the the most suitable type of equip- or bringing up the water and the uent treatment of the water can rmined. Rotary pumps, hydraulic , windmills, hand pumps and so on used for their particular purpose. ill-driven pumps are favourites in country areas.

SE TO SEA

interesting point in the recovery erground water is that in relation aining fresh water supplies from sunk close to the sea shore.

oastal areas the movement of fresh is downwards towards the sea the fresh water rests in a layer of the salt water. To use the of Mr E. R. Smith, principal er of the New South Wales Water vation and Irrigation Commission:

fresh and salt water horizons do et on a horizontal plane but the vater body takes on the shape of er flat, inverted cone, resting on tending downwards into the salt ody, quite often well below mean el."

goes on to say:—

s apparent phenomenon explains esh water wells are often found ea shores close to high tide levels.

en a bore obtaining fresh water he ground water adjacent to bodies water is pumped, a cone or de- n in the water surrounding the formed and at the same time a steeper cone of intrusion of salt is formed in the body of fresh mmediately below the bore. Con- pumping extends this salt water f intrusion until it can eventually the bottom of the bore when salt only will be pumped up through re."

LEM EXPLAINED

diagram herewith supplied by y of the Water Conservation and on Commission of New South explains this interesting phenom- uite clearly. It will solve what nystery to many people, namely resh water can be obtained so o the sea.

n the foregoing it will become nt that Australia is indeed fortu- having such a widespread system sian basins. It is a factor which ved many a grazier and farmer enormous losses during times of nt rainfall and has made the life inland much more bearable.

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Measure both inside and outside diameters.

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14/6
(Post for all 2/6)

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Standard type set at a lower than standard price.

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SIZE: 1½inch Front O.D. to
1⅛inch Rear O.D. by
7½ inches Long.
CONNECTION. Locking 3 pin Can
SWIVEL. 5/8 inch 26 T.P.I. to
1⅛ inch slotted clamp.

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ERVICEMAN

Continued from Page 37)

modified circuit was actually than the one it was to replace, ommenced by removing all the ing to the lower 6V6 grid, as the feedback network. A number or components were tossed out process, and I was able to tidy e of the gross errors of layout. circuit which went back in con- imply of a small resistor (my e had suggested 1500 ohms) ed in series with the upper 6V6 from which point a coupling r connected to the lower 6V6 e screen was bypassed for R.F. audio, so that a suitable value o voltage was generated across l, by careful selection of the value, the voltage could be made equal to that on the upper 6V6

ICITY

ps I could have left the original k network intact, but I felt that, essentially simple amplifier, the ven "resistor from plate to plate" advantage of simplicity while erfectly adequate.

with everything in place, I l on and watched the CRO for instability. Instead, a nice sine ttern unfolded as the set warmed ile not conclusive, it was at least, improvement on the previous

step was to check the balance two output stages, which I did ly connecting the CRO lead to id in turn and comparing the de on the graticule over the ube face. This showed that the the lower valve was marginally than that to the upper one; a n I corrected quite simply by the 1500 ohm screen resistor uch higher values until the sig- re equal.

I wound the gain up until the stages were approaching overload, o check, at least roughly, whether delivering normal power output, rtly to check the possibility of ther instability. It was just as id. Long before full output the ave spread out into a classic on pattern over about 45 degrees cycle. It was a typical case of on due to shock excitation.

was somewhat discouraging, par- as I had already cleaned up the layout likely to cause this As far as I could see I had e trick left, "stopper" resistors in d of each 6V6, and I put the o practice immediately. A couple K, half watt types, close up to id, were fitted in a few minutes, tried again.

did it. I could now drive the vell into overload without any oscillation of any kind, while m power output was within distance of the valve manu- 's figure. The set was a far cry e lopsided monster I had started , apparently, almost ready to go the customer.

almost because, flushed with my so far, I couldn't resist the ion to switch the generator to are wave position. I should have better, of course; circuits like this simply weren't made for such tests, and this one was no exception. It was ringing like a parish full of church bells on a Sunday morning.

I consoled myself with the thought it probably wasn't any worse than most run-of-the-mill domestic receiver of the same general type, that I already had achieved a worthwhile improvement, and that it was doubtful whether I could do much about it anyway.

Nevertheless, I decided to give it a quick try. A run over the response curve showed some nasty peaks around the 20-25 Kc region, and I guessed that these were the cause. The simplest approach seemed to be to restrict the top response as much as possible, and I started by bypassing the plate of the driver stage with various likely capacitor values.

I forget the exact value I finished up with but, as usual, it had to be a compromise. It was easy enough to find a value which virtually wiped the ringing, but only at the expense of top response as indicated by severe rounding of the "square" wave. On the other hand, some top loss had to be tolerated in order to achieve reasonable control.

When I had selected what looked to be a reasonable value I checked the overall response. It was beginning to roll at around 10 Kc, but I reasoned that this was not a serious objection. After all, it was unlikely that the gear would ever be asked to handle such frequencies, or that the speaker could do much with them if it did.

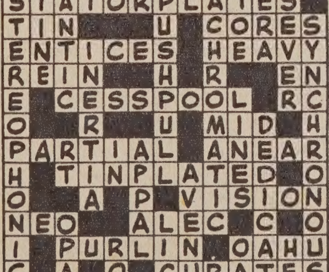
And that was how it finished up; normal power output, adequate frequency range, and quite reasonable square wave response. While not high fidelity by any means, I felt the fact that it would even look at a square wave at all was a worthwhile achievement, considering the grossly unstable thing I had started on.

This has been a long story and it may appear to have been a long service job considering the age of the set in question. To a point this is true and, in other circumstances, it might not have been a proposition. However, one learns to treat each case on its merits, and this particular owner was expecially keen to have the set restored to the best possible condition, even if it cost a little more. So why should I quibble?

In any case, it made a good story.

R., TV & H. CROSSWORD

Last month's solution



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	E	L	S	T	R	E	E		R	E	N	

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WEIRD AUDIO

(Continued from Page 17)

the meaning of the writer or artist and help to bring his vision to life for listeners and viewers.

It is entirely appropriate that activities which to the layman have a touch of the magical should have been described 300 years and more before they became possible.

There could hardly be a more apt description of what goes on in the B.B.C. Radiophonic Workshop than in these extracts from Sir Francis Bacon's "The New Atlantis" published in 1624: "Wee have also Sound-houses, wher wee practise and demonstrate all Sounds, and their Generation. Wee have Harmonies which you have not, of Quarter-Sounds, and lesser Slides of Sounds . . . Wee represent Small Sounds as Great and Deepe; Likewise Great Sounds, Extenuate and Sharpe; Wee make diverse Tremblings and Warblings of Sounds, which in their Originall are Entire . . . Wee have also diverse Strange and Artificiall Eccho's, Reflecting the Voice many times, and as it were Tossing it; And some that give back the Voice Lowder than it came, some Shriller, and some Deeper; Yea some rendring the Voice, Differing in the Letters or Articulate Sound, from that they receyve. Wee have also meanes to convey Sounds in Trunks and Pipes, in Strange Lines, and Distances."

TRANSISTOR AMPLIFIER

(Continued from Page 69)

making a useful three transistor portable/mantel set. The circuit referred to is at the top of page 77 of the above issue.

By building these two items into one self-contained unit we will no longer require the phone jacks for the speaker and inter-unit connections and we may not require the volume control, depending on the reaction control for gain adjustment. However, there is generally some advantage in retaining a volume control where there is substantial gain following a regenerative detector.

To connect the detector to the amplifier, the phones are replaced by a 6800 ohm resistor. Coupling is via the 5 mfd electrolytic capacitor already in the amplier circuit but note particularly that the polarity of this capacitor should be reversed when preceded by the detector stage, to allow for the voltage on the detector collector.

The three volt battery supplying the amplifier can also supply the regenerative stage, but it will be necessary to decouple the negative supply line to the detector. This may consist of a 1000 ohm series resistor and a 50 mfd electrolytic capacitor to earth.

Very good results are possible from a receiver built up in this way and, as our amplifier will function on supply of up to 9 volts, you may wish to use this or some intermediate voltage, providing that the physical space is made available.

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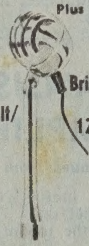

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